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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
HELIUM ACTIVITY
HELIUM RESEARCH CENTER

INTERNAL REPORT

COMPRESSIBILITY DATA FOR HELIUM AT 0° C AND

PRESSURES TO 800 ATMOSPHERES

BY

Ted C. Briggs

BRANCH Fundamental Research

PROJECT NO. 4330

DATE March 1966

AMARILLO, TEXAS

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Ted C. Briggs[1/]

ABSTRACT

Twenty-two compressibility runs were made with helium at 0° C. The apparatus used to obtain the data is described. The experimental procedure is described. The method used to calculate a corrected pressure from the experimental observations is discussed in detail. The data were fitted to an equation of the form $Z_r = 1 + BP_r + CP_r^2$ and the results are presented.

INTRODUCTION

Numerous compressibility runs were made with helium at 0° C starting at approximately the same initial pressure. The purpose of making multiple runs at one temperature was to test the statistical agreement between runs, to test a functional form for representing the data, and to ultimately present precise new data for the compressibility factors of helium at 0° C.

1/ Research chemist, Helium Research Center, Bureau of Mines, Amarillo, Texas.

Work on manuscript completed March 1966.

EXPERIMENTAL APPARATUS

The experimental apparatus used to obtain the data of this report was a conventional Burnett (9)[2/] type compressibility apparatus.

2/ Underlined numbers in parentheses refer to items in the list of references at the end of this report.

The original Burnett compressibility apparatus consisted of two volumes designated as V_1 and V_2, equipment to control and measure the temperature of V_1 and V_2, and equipment to measure the pressure of a gas sample confined in the volume V_1 or V_1+V_2. The compressibility apparatus used in this investigation was quite similar to Burnett's original apparatus. Burnett's original apparatus had a volume ratio $\left(\frac{V_1+V_2}{V_1}\right)$ of approximately two as did the apparatus used in this investigation. The original Burnett apparatus had oil jackets around the gas pressure bombs. Burnett's apparatus was arranged to have oil pressure in the jackets equal the gas pressure confined in the bombs. For a thick wall cylinder, this arrangement reduced, but did not eliminate elastic pressure distortion of the compressibility bombs. The present compressibility apparatus also had oil jackets around the gas bombs; however, the oil jacket-pressure system was separate from the oil pressure system of the piston gage. The oil jackets of the present compressibility apparatus were used to help determine pressure distortion coefficients as reported in references (4), (5), (6), and (7). The oil jackets were not used during any of the compressibility runs of this report.

The compressibility bombs used in this investigation were fabricated in the Amarillo Helium Plant machine shop. All other major equipment items incorporated in the present compressibility apparatus were commercially available.

Dimensions of the jacketed bombs, a description of the components of V_1 and V_2; and an estimate of the volumes of V_1 and V_2 were recorded in reference (5)[3/]. All of the components constituting V_1 and

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3/ The high-pressure jacketed bombs used in this investigation were designed by John E. Miller, Research Chemist, Helium Research Center, Bureau of Mines, Amarillo, Texas. The dimensions of the jacketed bomb illustrated in reference (5), figure 1, page 6, were supplied to this writer by John E. Miller.

V_2 were assembled in a constant temperature bath; therefore, all of the gas sample confined in volume V_1 or V_1+V_2 was at the bath temperature.

The constant temperature bath used in this investigation was a Chandler Engineering Company[4/] Model No. 22-1 bath assembly. The

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4/ Manufacturers were identified in this report for descriptive purposes only, and this identification should not be construed as endorsement or recommendation of any particular product or manufacturer.

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bath was supplied with a 1,000 watt immersion heater, a 500 watt

immersion heater controlled by a variable transformer, and a 100 watt immersion heater. The bath was supplied equipped with heat exchange coils of 1/4" od copper tubing through which various fluids could be circulated. Refrigeration was supplied to the compressibility bath by pumping fluid through the heat exchange coils from an external tank. The external tank contained a 750 watt immersion heater, a 500 watt immersion heater controlled by a variable transformer, a 100 watt immersion heater, and the refrigeration coils of a Tecumseh Model No. C2513HTK refrigeration unit. The refrigeration unit was controlled by a relay system actuated by a mercury thermoregulator. Temperature of the fluid in the external tank was controlled within about $\pm$ 0.03° C of the set temperature by the on-off action of the Tecumseh refrigeration unit. Fluid was pumped from the external tank through the heat exchange coils of the compressibility bath by a Viking Model No. F656G positive displacement pump with a built-in relief valve. There was a pressure drop of about 50 psi through the heat exchange coils. Fine temperature control of the compressibility bath was obtained by supplying a small amount of extra refrigeration to the bath and controlling the temperature with the 100 watt immersion heater. Power to the 100 watt immersion heater was supplied through a Hallikainen Thermotrol temperature controller with a Model No. 1080 temperature-sensing element. The controller was actuated by a $\pm$ 0.001° C change in the bath temperature. The Hallikainen temperature controller was of the proportional with reset type; therefore, the controller supplied only enough power to the 100 watt heater to maintain the set temperature, and avoided the

temperature fluctuations experienced with on-off type controllers.

The compressibility bath was filled with a ten percent by volume methyl alcohol in water antifreeze mixture for the 0° C compressibility runs. The bath was stirred by an internal circulating pump and by a 1/30 h.p. Aminco electrical stirrer. A fifty percent by volume ethylene glycol in water antifreeze mixture was circulated from the external tank through the compressibility bath heat exchange coils.

Compressibility bath temperatures were measured with a Leeds & Northrup Model No. 8163, Serial No. 1586182 platinum resistance thermometer. The thermometer was calibrated by the company at the ice point, steam point, boiling point of sulphur, and boiling point of oxygen. Constants were supplied by the company for use in the Callendar and modified Callendar temperature interpolation formulas. Temperatures measured with the platinum resistance thermometer were in terms of the International Practical Temperature Scale. The manufacturer stated that the calibrated thermometer would reproduce temperatures on the International Practical Temperature Scale within $\pm$ 0.01° C provided the thermometer was used with a calibrated resistance bridge and provided a reliable value was used for the resistance of the thermometer at the ice point. A value for the ice point resistance of platinum resistance thermometer, Serial No. 1586182, was determined in this laboratory (2). Thermometer resistances were measured with a Leeds & Northrup Company Model No. 8069 G-2 Mueller bridge, Serial No. 1603629. A constant current of 2

milliamperes was supplied to the thermometer for all resistance measurements. The G-2 Mueller bridge was calibrated by the manufacturer and corrections were provided with sufficient precision to determine a resistance or change of resistance greater than 1 ohm to about 2 parts in 100,000. The Model No. 8069 bridge could measure resistances over the range 0 to 111.111 ohms. The smallest decade step was 0.0001 ohm. A temperature change of 0.001° C changed the resistance of the platinum resistance thermometer by about 0.0001 ohm at 0° C. The G-2 Mueller bridge was supplied equipped with a mercury contact commutator for reversing the connections to the four lead platinum resistance thermometer for the purpose of cancelling the effect of thermometer lead resistance. Critical resistance coils of the Model No. 8069 bridge were mounted in a thermally insulated block whose temperature was kept constant by means of an electrical heater controlled by a thermoregulator. This arrangement eliminated the need to make temperature corrections to the bridge resistance readings. A Keithley Instruments, Inc. Model No. 149 electronic milli-microvoltmeter was used as a null-detector for the G-2 Mueller bridge. The milli-microvoltmeter had a range of measurements from 0.1 microvolt full scale to 100 millivolts. One minor irritation experienced with the null-detector was that everytime the Mueller bridge thermoregulator came on, the null-detector would go off scale; therefore, all thermometer resistance measurements were made when the bridge thermoregulator was off. The null-detector also seemed rather sensitive to line voltage disturbances; however, the electronic null-detector eliminated many of the

problems associated with the use of a moving-coil galvanometer.

Gas samples in the compressibility bombs were separated from oil of the pressure-measuring system by a Ruska Instrument Corporation Model No. 2416, Serial No. 9032 differential pressure cell. The differential pressure cell used in this investigation was modified by the manufacturer so the cell could be immersed in the compressibility bath fluid. The cell was designed to safely withstand an overpressure of 15,000 psi on either side of the diaphragm. Oil of the pressure-measuring system was separated from gas of the sample system by a thin stainless steel diaphragm located within the cell. The position of the diaphragm was established by the movement of a stem soldered to the diaphragm. As the diaphragm moved, the stem moved a core within the coils of a very sensitive differential transformer. Output of the differential transformer was indicated by an electronic meter. The maximum sensitivity of the differential pressure cell and meter was about 0.0001 psi. The differential pressure cell meter was zeroed before each run with atmospheric pressure applied to both sides of the diaphragm. The zero of the differential pressure changed with increasing operating pressure due to pressure distortion of the cell. Ruska Instrument Corporation provided the calibration data necessary to correct for a change of the cell zero due to a change of the cell operating pressure. Large overpressures were avoided on either side of the diaphragm in order to prevent a change of the cell zero during a compressibility run. It was not possible to apply a numerical

correction for zero shift due to overpressures; therefore, large overpressures were not applied to either side of the diaphragm during a run, and any small overpressures were applied consistently to the oil side of the diaphragm. Gas pressures on the sample side of the diaphragm were balanced on the oil side of the diaphragm by an oil lubricated dead weight piston gage. The piston gage used in this investigation was a Ruska Instrument Corporation Model No. 2400 gage, Serial No. 9274. The gage was calibrated by the manufacturer by comparison against Ruska Instrument Corporation master gage Serial No. 7544. The area of the master gage was determined at the National Bureau of Standards and was reported to be correct to one part in 10,000 at 25° C. The comparison of gage No. 9274 against the master gage was carried out with a precision of a few parts per million; therefore, the calibration accuracy of gage Serial No. 9274 should be essentially the same as the accuracy of the master gage. Ruska Instrument Corporation supplied calibration data for the individual piston gage weights, a value for the piston gage area at 25° C, a coefficient to correct for a change of piston gage area as a function of pressure, and a coefficient to correct for change of gage temperature from the calibration temperature. The range of the gage used in this investigation was from 30 to 12,140 psig. The minimum resolution of the gage was stated by the manufacturer to be 5 parts per million at full load decreasing to 50 parts per million at empty weight. The height of the piston gage reference plane was adjusted, by placing brass blocks under the piston gage legs, to correspond to the level of the diaphragm of the differential pressure cell and to

the zero of the oil manometer; therefore, the necessity of making oil head pressure corrections was eliminated. The pressure bombs were placed horizontally in the bomb bath. The center of the jacketed bomb portion of V_1 was about 7.0 cm below the level of the diaphragm and the center of the jacketed bomb portion of V_2 was about 10.2 cm below the level of the diaphragm. Pressure in the oil system was adjusted by use of a Ruska Instrument Corporation oil displacement pump. A Ruska Instrument Corporation Model No. 2409 oil manometer was located in the oil system. The zero of the oil manometer was adjusted to correspond to the level of the diaphragm of the differential pressure cell.

Barometric pressures were measured with a Henry J. Green Instruments, Inc. Model No. 16, Serial No. 13346 Fortin type mercurial barometer. The barometer was calibrated at the National Bureau of Standards. All barometer readings for the data of this report were made to the nearest 0.05 millimeter of mercury. Reduction of observed barometer readings to standard conditions has been discussed in Helium Research Center Internal Report 68 (3).

Relative humidity in the PVT laboratory was measured with a sensitive hygrometer manufactured by Bacharach Industrial Instrument Company. The manufacturer stated an accuracy of $\pm$ 1.5 percent relative humidity for the hygrometer.

Volume V_2 of the PVT apparatus was evacuated by a Welch Scientific Company Model No. 1400B high-vacuum pump. The manufacturer claimed an ultimate vacuum capability of 0.1 micron for the Model No. 1400B vacuum pump.

The degree of vacuum in V_2 was measured with a Consolidated Vacuum Corporation Model No. GPH-100A vacuum gage with a No. GPH-001 cold cathode ionization tube. The vacuum gage was designed to measure pressures over the range 1×10^{-7} to 25×10^{-3} millimeters of mercury. The actual degree of vacuum attained in volume V_2 of the compressibility apparatus, as indicated by the vacuum gage, ranged between ten and five microns.

The compressibility bombs were filled with gas by use of a Corblin Model No. B2C 1000 diaphragm type compressor. The compressor was designed for use to 15,000 psi, and had a compression ratio of twenty to one.

An unscaled diagram of the gas pressure system of the compressibility apparatus is included in this report as figure 1. An unscaled diagram of the oil pressure system is illustrated in figure 2. An unscaled illustration of the constant temperature bath system along with some of the major components of the compressibility apparatus is included in this report as figure 3. V_{b1} and V_{b2} of figures 1, 2, and 3 illustrate the jacketed bomb portions of V_1 and V_2. Figures 1, 2, and 3 are not intended to show minute details of the compressibility apparatus, but are intended to illustrate the general arrangement of most of the major components of the compressibility apparatus. The valves of the compressibility apparatus are numbered in figures 1 and 2 and the valve functions are listed in table 1.

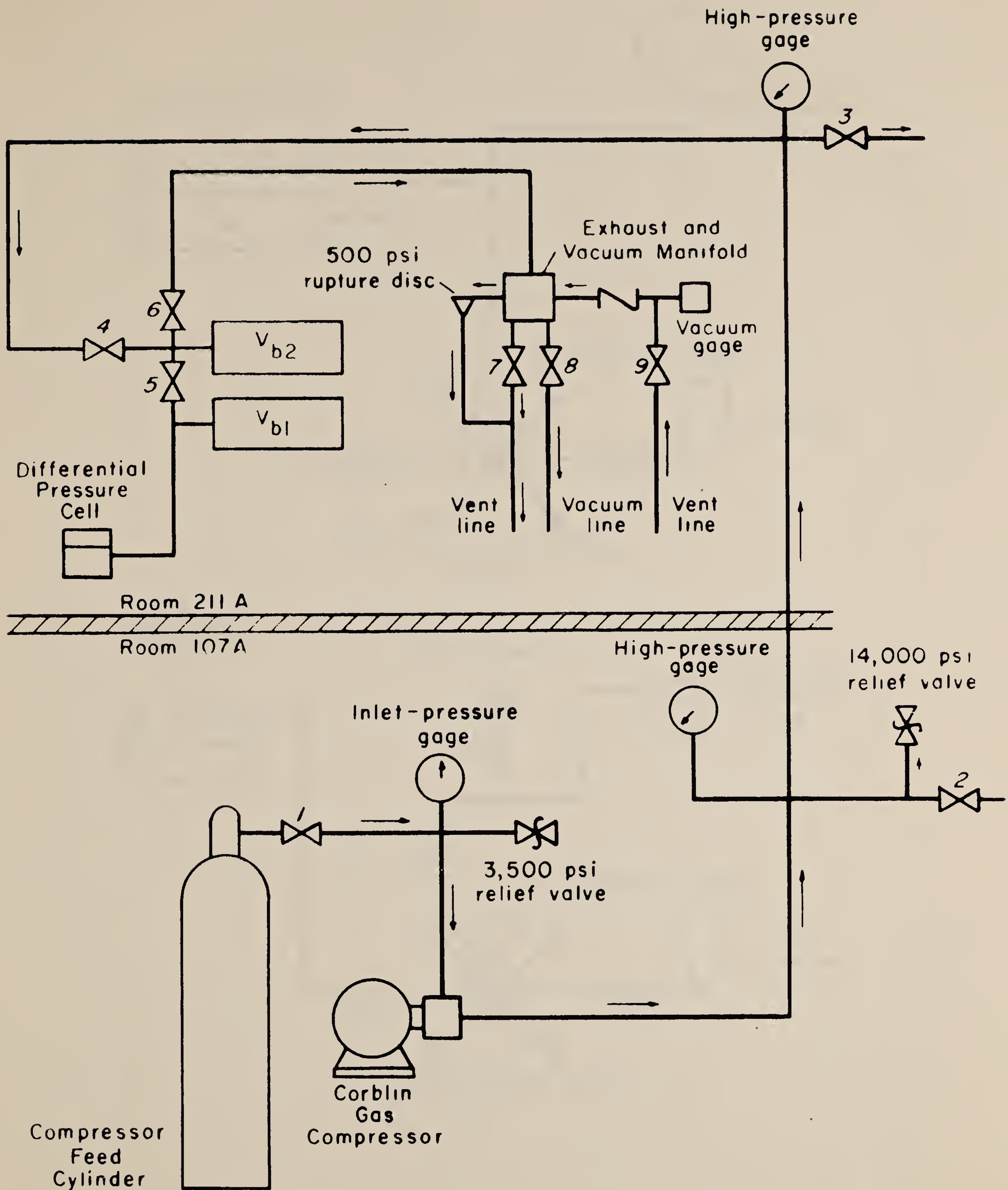

FIGURE 1. – Gas Pressure System of the High-Pressure Compressibility Apparatus.

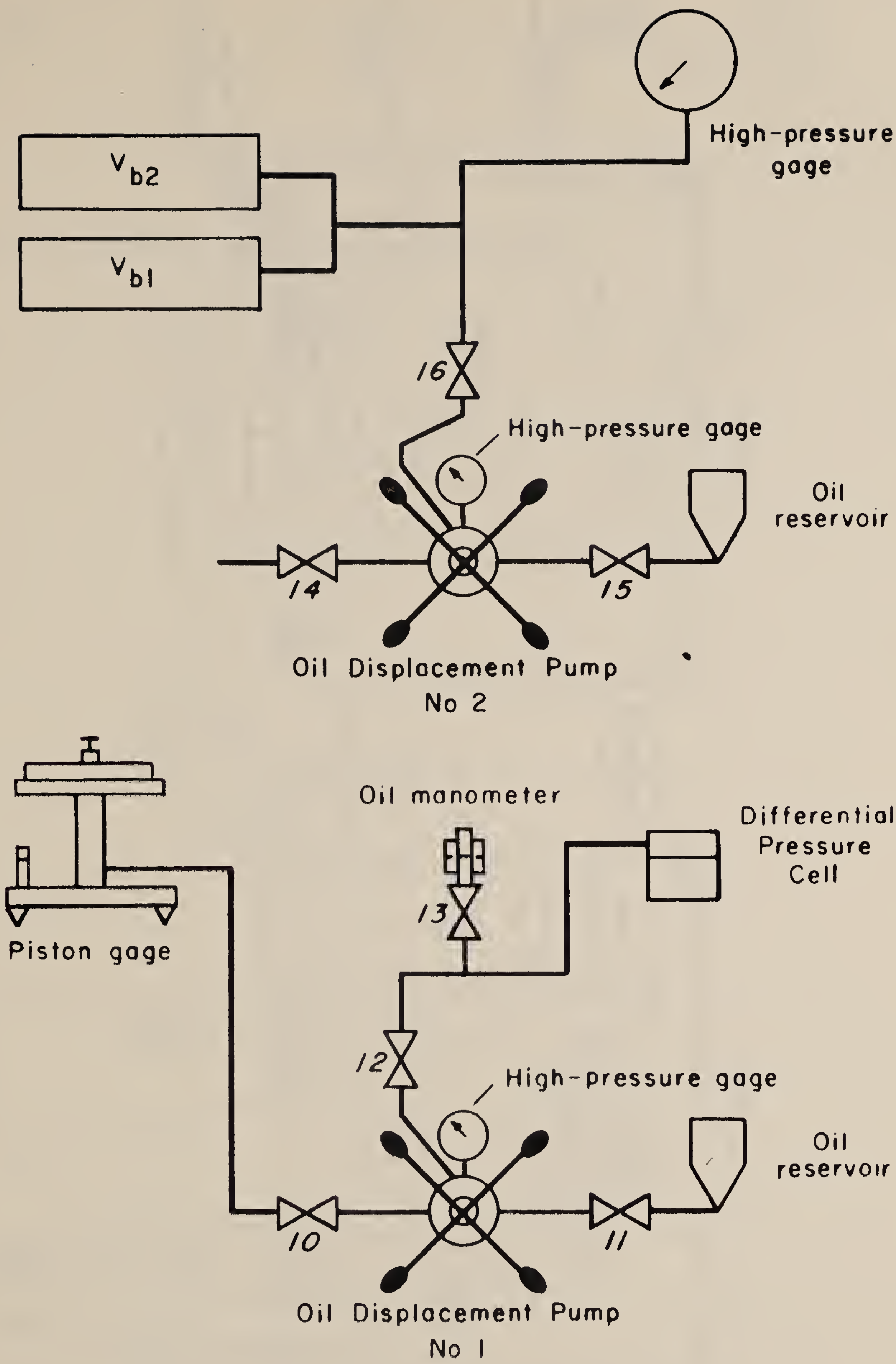

FIGURE 2. — Oil Pressure System of the High-Pressure Compressibility Apparatus.

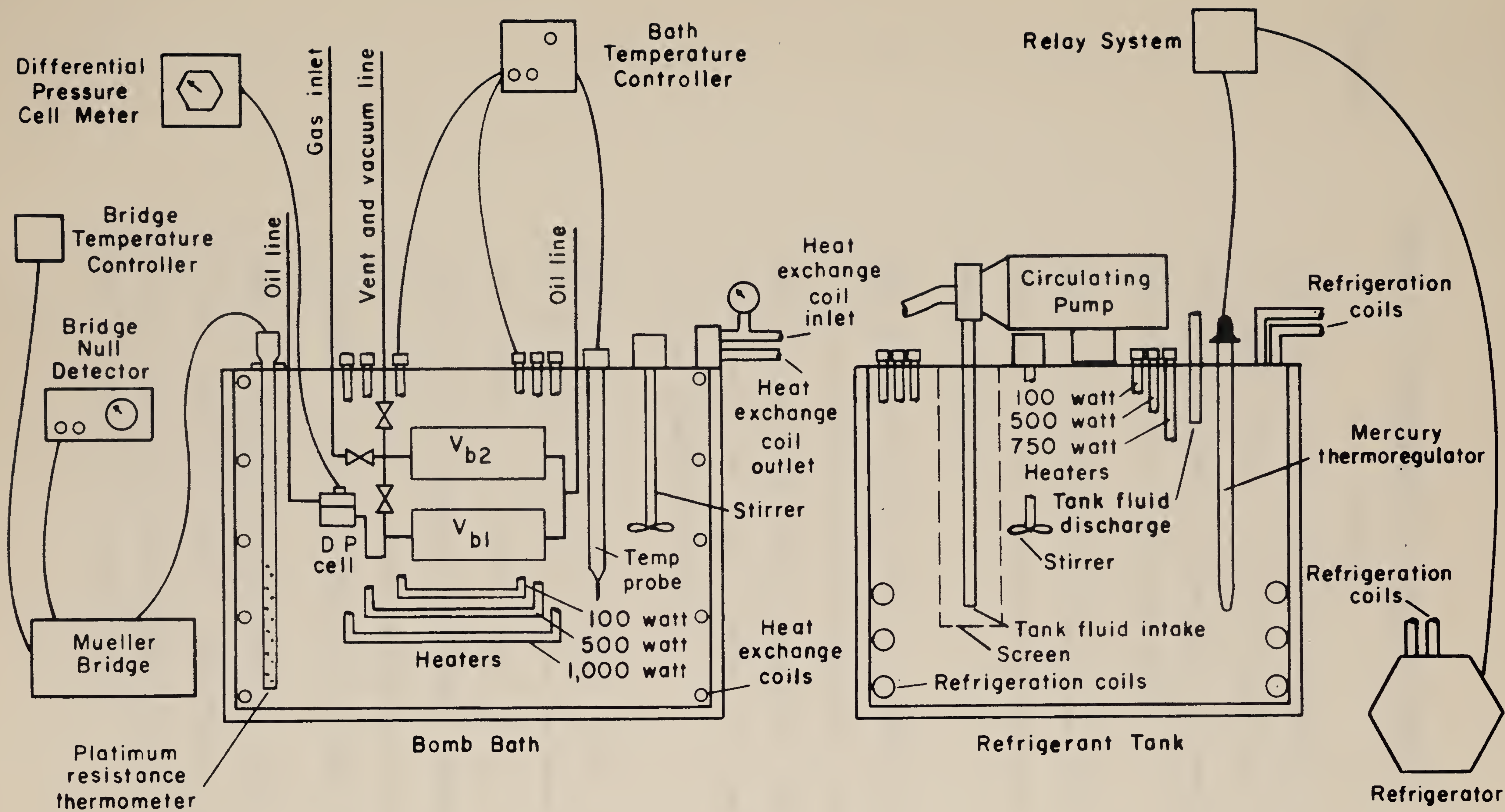

FIGURE 3 – Constant Temperature Bath System and Some of the Major Components of the High–Pressure Compressibility Apparatus.

TABLE 1. - Compressibility apparatus valves

Valve No.	Function
1	Inlet valve to the Corblin gas compressor from the gas supply cylinder. Valve was open when filling the gas system and when operating the compressor. Valve was closed at all other times.
2	High-pressure gas outlet valve to room 107A. Valve was closed at all times during all steps of a compressibility run.
3	High-pressure gas vent valve to outside of Building A. Purpose of the valve was to provide a means of rapidly venting gas from the compressor lines in case of emergency. Valve was closed at all times during a routine compressibility run.
4	Inlet valve to the compressibility bombs. Valve was open during evacuation of the compressor lines, during purging of the system with test gas, during filling of the compressibility bombs, and when gas was vented from the compressor lines during routine operation. Valve was closed at all other times.
5	Expansion valve separating volumes V_1 and V_2. Valve was open when evacuating V_1, when filling V_1 with test gas, and when expanding gas from V_1 to V_2. Valve was closed at all other times.

TABLE 1. - Compressibility apparatus valves (Con.)

Valve No.	Function
6	High-pressure exhaust valve from the compressibility bombs. Valve was open when evacuating V_1, V_2, or the compressor lines. Valve was open when venting gas from V_1, V_2, or the compressor lines during routine operation. Valve was closed at all other times.
7	Low-pressure (3,000 psi) valve to vent line to outside of Building A. Valve was FULL OPEN WHEN VENTING HIGH-PRESSURE GAS THROUGH VALVE 6. Failure to open valve 7 when venting high-pressure gas through valve 6 would have resulted in a ruptured relief disc. Valve was closed when evacuating any part of the gas system. Valve was open at all other times.
8	Valve to vacuum line. Valve was open when evacuating any part of the gas system. Valve was closed at all other times.
9	Valve to admit atmospheric pressure to the vacuum gage ionization tube. Valve 9 was full open when venting gas through valve 6. Valve was closed when evacuating any part of the gas system. Valve was open at all other times.

TABLE 1. - Compressibility apparatus valves (Con.)

Valve No.	Function
10	Valve between oil displacement pump and piston gage. Valve was open when measuring a pressure with the piston gage. Valve was closed to isolate the piston gage from the remainder of the oil pressure system.
11	Valve to oil reservoir. Valve was open when filling the displacement pump with oil. Valve was closed at all other times.
12	Valve between oil displacement pump, and oil manometer and differential pressure cell. Valve was open when measuring a pressure with the piston gage. Valve was closed to isolate the differential pressure cell and oil manometer from the remainder of the oil pressure system.
13	Valve to the oil manometer. Valve was open when the differential pressure cell meter was zeroed. Valve was closed at all other times.
14	Spare outlet valve from oil displacement pump. Valve was closed during all compressibility runs.
15	Valve to oil reservoir. Valve was open during all compressibility runs.

TABLE 1. - Compressibility apparatus valves (Con.)

Valve No.	Function
16	Valve from oil displacement pump to compressibility bomb jackets and Heise Bourdon tube gage. The oil jackets were not used during a compressibility run; therefore, valve was open during all compressibility runs.

EXPERIMENTAL PROCEDURE

The Burnett compressibility method has been described in the literature (9). The following description outlines the procedure used to obtain the data recorded in this report.

The temperature of the bomb bath was lowered to 0° C by pumping refrigerated fluid through the compressibility bath heat exchange coils. The compressibility bath temperature controller and the refrigerator mercury thermoregulator were adjusted until the compressibility bath temperature was maintained at the desired level. The temperature of the external tank was controlled at about -3.5° C in order to compensate for heat leak and maintain the compressibility bath at 0° C.

The gas side of the differential pressure cell was opened to atmospheric pressure. The valve to the oil manometer was opened, and the level of the oil in the manometer was adjusted to correspond to the level of the diaphragm of the differential pressure cell. The readout meter of the differential pressure cell was set at maximum sensitivity, and the meter was zeroed.

The gas system of the compressibility apparatus was evacuated, then purged and filled to supply cylinder pressure with test gas. The evacuated volume V_1 of the compressibility apparatus was filled with test gas by slowly expanding the gas from V_2 into V_1 while simultaneously maintaining a slight overpressure on the oil side of the differential pressure cell diaphragm. The valve between V_1 and V_2 was closed, and V_2 was filled with test gas to a high pressure

by use of the Corblin gas compressor. Then V_1 was filled with test gas at high pressure by expansion from V_2 while simultaneously maintaining a small overpressure on the oil side of the differential pressure cell diaphragm by use of the oil displacement pump. The valve was closed between V_1 and V_2, and the gas in V_2 was vented to the atmosphere. Volume V_2 was evacuated with the vacuum pump. The rather awkward filling procedure described above was necessary because the compressor and compressor controls were located in one room, the remainder of the compressibility apparatus was located in another room, and it was necessary to avoid large overpressures on either the oil or gas sides of the differential pressure cell diaphragm.

The gas in V_1 was allowed to reach temperature equilibrium. Gas pressure in V_1 was balanced with oil pressure by adjusting weights on the piston gage until the differential pressure cell meter indicated the null position. Temperature equilibrium was assumed to be established when the piston gage indicated a stable pressure. The designations of weights on the piston gage, piston gage temperature, barometer scale reading, barometer temperature, relative humidity, and the resistance of the platinum resistance thermometer were recorded. The differential pressure cell was closed off from the oil pump and piston gage, and the piston gage was lowered to its rest position by slowly decreasing the pressure with the oil displacement pump. The piston gage was isolated from the system by closing the valve between the oil pump and the piston gage. Oil pressure was raised to equal the gas pressure by use of the oil displacement pump,

and the valve to the differential pressure cell was opened. The vacuum in V_2 was measured with the vacuum gage, the valve to the vacuum pump was closed, and the high-pressure exhaust valve from V_2 was closed. Gas in V_1 was slowly expanded into the evacuated V_2. A small overpressure was maintained on the oil side of the differential pressure cell diaphragm during the expansion. It was important that any overpressure be maintained consistently on the oil side of the diaphragm. If large overpressures had been applied alternately to the oil and gas sides of the diaphragm, there would have been a change in the zero position of the diaphragm. Zero shift of the diaphragm due to large overpressures, alternately on the oil and gas sides of the diaphragm, could have introduced errors of as much as 0.02 psi in the measured pressures.

Gas in V_1 and V_2 was allowed to reach thermal equilibrium. The piston gage was isolated from the system, and the differential pressure indicator was maintained in the zero position with the oil displacement pump as the expansion valve between V_1 and V_2 was slowly closed. After the expansion valve was closed, gas in V_2 was vented to the atmosphere, and V_2 was evacuated. The valve to the piston gage was reopened. Weights on the piston gage were readjusted until a null position was indicated by the differential pressure cell meter. All of the necessary observations were recorded. Then another expansion was made from V_1 into an evacuated V_2. The measuring and expansion sequence was continued until the lowest pressure that could be measured with the piston gage was reached.

CALCULATION OF CORRECTED PRESSURES FROM THE EXPERIMENTAL OBSERVATIONS

A computer program was written, by the Data Processing Branch, to calculate corrected absolute pressures from the experimental observations. Explicit instructions were given to the Data Processing group for each step in the pressure calculations.

The first step of the calculations was to evaluate a corrected barometric pressure from the observed barometer scale reading and barometer temperature. National Bureau of Standards Monograph 8 (8) was used as a reference for reduction of barometer readings to standard conditions.

Let: R_s = uncorrected barometer scale reading, mm

t_b = barometer temperature, °C

R_t = barometer reading corrected for temperature effects, mm

R_g = barometer reading corrected for gravity effects, mm

R_c = barometer reading corrected to standard conditions, mm

$R_t = R_s + C_t$

C_t = barometer temperature correction, mm

$C_t = \dfrac{(s-m)t_b R_s}{1 + mt_b}$ (1), reference (8), page 28

s = coefficient of linear expansion of barometer scale (brass) = 18.4×10^{-6} per °C, reference (8), page 28

m = mean cubical coefficient of thermal expansion of mercury

$m \times 10^8$ = $18144.01 + 0.7016t_b + 0.0028625t_b^2 + 0.000002617t_b^3$ per °C (2), reference (8), page 4

R_g = $R_t + C_g$

C_g = barometer gravity correction

C_g = $\dfrac{g_1 - g_s}{g_s} R_t$ (3), reference (8), page 33

g_1 = local acceleration of gravity = 979.4091 cm sec^{-2} (11)

g_s = standard acceleration of gravity = 980.665 cm sec^{-2}

R_c = $R_s + C_t + C_g + C_c$, mm

C_c = calibration correction provided by the National Bureau of Standards for Henry J. Green barometer Serial No. 13346, (3) = +0.06 mm

$\dfrac{R_c}{760}$ = corrected barometer reading, standard atmospheres

The next step was to calculate a corrected piston gage pressure from the experimental observations. National Bureau of Standards Monograph 65 (10) was used as a reference for reduction of piston gage data. Equation (4) was used to calculate a gage pressure

$$P_g = \frac{M_a(1 - \rho_a/\rho_b)g_1/g_s}{A_o(1 + bP_g)[1 + c(t_g - 25)]} + C_d \qquad (4)$$

for piston gage, Serial No. 9274. The calibration constants for piston gage, Serial No. 9274 were provided by Ruska Instrument Corporation.

P_g = corrected gage pressure, psig

M_a = sum of the individual masses of the weights on the piston gage, lbs

ρ_a = density of air, gms cm^{-3}

ρ_b = density of brass[5/] = 8.4 gms cm^{-3}

5/ The large piston gage weights were machined from 303 stainless steel. The very small weights were probably constructed of aluminum. All of the weights were calibrated by Ruska Instrument Corporation by comparison in air against class S standard weights. The standard weights used by Ruska Instrument Corporation were calibrated by the National Bureau of Standards and were traceable to brass standards with a density of 8.4 gms cm^{-3}. The calibrated piston gage weights were reported by Ruska Instrument Corporation as apparent mass in air against brass standards; therefore, the density of brass of 8.4 gms cm^{-3} was used in equation (4) rather than the actual density of the weights; reference (10), page 3.

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g_1 = local acceleration of gravity = 979.4091 cm sec^{-2}

g_s = standard acceleration of gravity = 980.665 cm sec^{-2}

A_o = piston gage area at 25° C and zero pressure = 0.0260416 in^2

b = piston gage pressure distortion coefficient = -3.5×10^{-8} psi^{-1}

c = piston gage temperature coefficient = 1.7×10^{-5} $°C^{-1}$

t_g = piston gage temperature, °C

C_d = differential pressure cell correction = $1.85 \times 10^{-6} P_g$

Barieau (1) presented equations for the calculation of the density of moist air.

$$\rho_a = \rho_o \frac{T_o}{T} \frac{R_c}{760} (1 - 0.37807y) \frac{Z_o}{Z} \qquad (5)^{6/}$$

6/ Equation (5) gave the density of moist air in gms liter^{-1} when used with a ρ_o of 1.2932 gms liter^{-1}. The density was changed to gm cm^{-3} for use in equation (4).

$$\frac{Z_o}{Z} = 1 - 0.000602 \left(\frac{R_c}{760} - 1\right) + (0.00254y + 0.0758y^2) \frac{R_c}{760}$$
$$-(0.0000105 + 0.0000131y + 0.00131y^2) t_b \frac{R_c}{760} \qquad (6)$$

T = absolute temperature = $(273.15 + t_b)$°K

T_o = absolute temperature of the ice point = 273.15° K

y = mole fraction of water vapor

ρ_o = 1.2932 gms liter^{-1}

Equation (7) was assumed to be valid for

$$y = \frac{P_s \times 760 \times H}{R_c} \qquad (7)$$

the calculations of this report.

P_s = vapor pressure of liquid water, standard atmospheres

H = relative humidity expressed as a decimal fraction

Osborne, Stimson, and Ginnings (13) presented equation (8) for calculation of the vapor pressure of water.

$$\log_{10}P_s = -3.142305\left(\frac{10^3}{T'} - \frac{10^3}{373.16}\right) + 8.2\ \log_{10}\left(\frac{373.16}{T'}\right)$$
$$-0.0024804(373.16 - T') \qquad (8)$$

$$T' = (273.16 + t_b)\ °K$$

The density of air was calculated using equations (5), (6), (7), (8), the corrected barometric pressure, the room temperature (t_b), and the observed relative humidity for each experimental piston gage pressure.

An approximate piston gage pressure was obtained by substitution of the sum of the masses of the weights on the piston gage, the calculated density of air, the piston gage temperature, and the calibration constants into equation (9).

$$P_{g(approx.)} = \frac{M_a(1 - \rho_a/\rho_b)\ g_1/g_s}{A_o[1 + c(t_g - 25)]} \qquad (9)$$

The approximate gage pressure calculated from equation (9), the experimental data, and the calibration constants were substituted into equation (4); and a new gage pressure was calculated. The new gage pressure was substituted back into equation (4) along with the experimental data and calibration constants; and another gage pressure was calculated. The iteration procedure was continued until the change in the calculated gage pressure was less than 0.0001 psig. The final pressure was accepted as the corrected piston gage pressure.

Constants used by Ruska Instrument Corporation in the calibration of piston gage, Serial No. 9274 were:

$$1 \text{ in} = 2.54 \text{ cm exactly}$$

$$1 \text{ lb} = 453.5924 \text{ gms}$$

An atmosphere in terms of the constants supplied by Ruska Instrument Corporation was:

$$1 \text{ atm} = \frac{1.013250 \times 10^{6} \times (2.54)^{2}}{453.5924 \times 980.665} = 14.69594780 \text{ psi}$$

Ruska piston gage pressure in psig was divided by 14.69594780 to obtain gage pressure in atmospheres. Absolute pressure in atmospheres was obtained by adding the barometric pressure in atmospheres to the piston gage pressure in atmospheres.

COMPOSITION OF THE TEST GAS

An experiment was run to determine if any impurities were introduced into the test gas while filling the compressibility bombs to the initial high pressure. An analyzed cylinder of grade A helium was attached to the inlet of the gas compressor. The gas system was evacuated and purged with test gas, and the bombs were filled to an initial pressure of about 10,000 psi. The filling of the bombs was carried out exactly as it would be done for a compressibility run. Gas was vented from the bombs, and a sample of the gas was trapped for analysis. The compressibility bombs were filled three times to pressures of about 10,000 psi, and three samples were trapped for analysis. A sample taken directly from the supply cylinder and the three vent samples were analyzed by high-pressure mass spectrometry.

The analyses are recorded in table 2. Examination of the data of table 2 indicates a slight increase in the nitrogen and oxygen content of the vent samples over that of the cylinder sample; however, the increase in total sample impurities is considered negligible and probably occurred during the sampling procedure rather than during the bomb filling procedure.

A total of twenty-two compressibility runs were made with helium at 0° C. Three helium cylinders were used to supply sample gas for the twenty-two runs. Analyses of impurities of each cylinder are recorded in table 3. The particular cylinder used for each compressibility run is listed below.

Run No.	Cylinder No.	Run No.	Cylinder No.
HE-0-1	H-135022	HE-0-12	AEC107250
HE-0-2	H-135022	HE-0-13	AEC107250
HE-0-3	H-135022	HE-0-14	AEC107250
HE-0-4	H-135022	HE-0-15	AEC107250
HE-0-5	H-135022	HE-0-16	AEC107250
HE-0-6	H-135022	HE-0-17	AEC107250
HE-0-7	H-135022	HE-0-18	AEC107250
HE-0-8	H-135022	HE-0-19	AEC107250
HE-0-9	AEC107250	HE-0-20	AEC103941
HE-0-10	AEC107250	HE-0-21	AEC103941
HE-0-11	AEC107250	HE-0-22	AEC103941

TABLE 2. - Analysis of vent samples, parts per million by volume impurities in helium

	H_2	CH_4	Ne	N_2	O_2	Ar	CO_2
Sample direct from Cylinder No. 25598	0.9	0.2	20.0	3.5	0.7	0.1	0.2
Vent sample No. 1	1.2	0.3	17.8	18.5	6.9	0.2	0.2
Vent sample No. 2	1.3	0.4	16.8	9.7	1.8	0.1	0.3
Vent sample No. 3	0.9	0.5	19.4	12.3	2.1	0.1	0.4

TABLE 3. - Helium cylinder analysis, part per million by volume impurities in helium

Cylinder Number	H_2	CH_4	H_2O	Ne	N_2	O_2	Ar	CO_2	Total
H-135022	0.4	0.0	0.7	15.2	1.4	0.3	0.0	0.0	18.0
AEC107250	0.0	0.0	0.8	11.8	2.5	0.6	Tr.[1/]	Tr.	15.7
AEC103941	0.3	0.0	0.9	11.7	0.6	0.1	0.0	0.1	13.7

1/ Tr. indicates less than 0.05 parts per million.

COMPRESSIBILITY-BOMB BATH TEMPERATURES

Temperature measurement with Leeds & Northrup platinum resistance thermometer Serial No. 1586182 has been discussed in Helium Research Center Internal Report No. 53 (2). Platinum resistance thermometer Serial No. 1586182 was mounted in the compressibility-bomb bath, and was used to measure the temperature of the bath fluid. Thermometer resistance measurements were made with the G-2 Mueller bridge commutator in both the N and R positions. Thermometer resistance measurements were made each time a piston gage pressure measurement was made. The average bath temperature for a complete compressibility run was assumed to be representative of the actual sample temperature. The large mass of the compressibility bombs tended to smooth out minor rapid fluctuations of the bath temperature. The average measured bomb bath temperature and the standard deviation of the average measured bomb bath temperature are recorded in table 4 for each of the twenty-two compressibility runs. Temperatures calculated from the measured resistances of platinum resistance thermometer Serial No. 1586182 are in terms of the International Practical Temperature Scale (IPTS).

CALCULATION OF CONSTANTS AND COMPRESSIBILITY FACTORS FROM THE OBSERVED PRESSURES

Initially, the assumption was made that compressibility factors for helium could be represented by equation (10) over the experimental pressure range.

$$Z_r = 1 + BP_r + CP_r^2 = \left(\frac{Z_o}{P_0}\right) f_r N^r P_r \tag{10}$$

TABLE 4. - Compressibility-bomb bath temperatures

Run No.	t,°C(IPTS)	Run No.	t,°C(IPTS)
HE-0-1	-0.006±0.001	HE-0-12	+0.003±0.000
HE-0-2	+0.002±0.001	HE-0-13	+0.002±0.001
HE-0-3	-0.001±0.001	HE-0-14	+0.003±0.001
HE-0-4	-0.001±0.000	HE-0-15	+0.002±0.000
HE-0-5	+0.001±0.001	HE-0-16	+0.003±0.001
HE-0-6	+0.003±0.001	HE-0-17	-0.001±0.001
HE-0-7	+0.002±0.001	HE-0-18	+0.002±0.001
HE-0-8	+0.004±0.001	HE-0-19	-0.001±0.001
HE-0-9	+0.003±0.001	HE-0-20	0.000±0.001
HE-0-10	+0.002±0.001	HE-0-21	+0.002±0.001
HE-0-11	+0.001±0.001	HE-0-22	0.000±0.001

$$f_r = \frac{(1 + \alpha_{1+2}P_1)(1 + \alpha_{1+2}P_2) \; \ldots \; (1 + \alpha_{1+2}P_r)}{(1 + \alpha_1 P_0)(1 + \alpha_1 P_1) \; \ldots \; (1 + \alpha_1 P_{r-1})} \qquad (11)^{7/}$$

7/ The coefficient α_{1+2} corresponds to the coefficient α of reference (12), equation (4), page 6. The coefficient α_1 corresponds to the coefficient β of reference (12), equation (4), page 6.

Z_r = compressibility factor at P_r

B = constant evaluated from the experimental pressures

C = constant evaluated from the experimental pressures

P_{r-1} = pressure before the r^{th} expansion

P_r = pressure after the r^{th} expansion

r = expansion number = 0, 1, 2, 3, ...

P_0 = pressure before the first expansion

Z_o = compressibility factor at P_0

f_r = factor to correct for elastic distortion of the compressibility bombs

$N = \dfrac{V_1^o + V_2^o}{V_1^o}$ = isothermal volume ratio at zero pressure

α_{1+2} = isothermal internal-pressure distortion coefficient for volume $V_1+V_2 = 1.6678 \times 10^{-6} \text{atm}^{-1}$ at 0° C, reference (7), page 34.

α_1 = isothermal internal-pressure distortion coefficient for volume $V_1 = 1.6671 \times 10^{-6} \text{atm}^{-1}$ at 0° C, reference (7), page 34.

Least squares calculation of the constants B, C, and N; evaluation of the standard errors of the constants; calculation of compressibility factors; and evaluation of the standard errors of the compressibility factors from the experimentally observed pressures were discussed in Helium Research Center Internal Report No. 69 (Rev.) (12). A computer program was written by the Data Processing group in compliance with instructions from the authors of Internal Report No. 69 (Rev.), to carry out the extensive calculations required in the data evaluation.

The computer-calculated results were printed out directly on multilith masters. The experimental pressures, least squares calculated pressures, constants, standard errors, variances, and covariances were printed out. The computer printed out the numerical quantities in "E format." For example, 6.4728895 E&02 represented 6.4728895×10^2, 7.8217009E-00 represented 7.8217009, and -3.77627E-04 represented -3.77627×10^{-4}. A weighting factor of one was used for all of the calculations of this report. No correction was applied to any of the runs for the difference between the actual average bath temperature and 0° C.

The column of numbers under the heading R in table 5 denotes the expansion number. The observed experimental pressures for each run are given in table 5. The least squares calculated pressures; the difference between the observed experimental pressures and the calculated pressures; and the relative difference of the observed pressures and the calculated pressures are recorded in table 5. The least squares calculated constants N, B, and C of equation (10) are

recorded in table 5. The standard errors of N, B, and C are designated as SN, SB, and SC, respectively; and are listed in table 5. The variances of N, B, and C are denoted as S2N, S2B, and S2C, respectively; and are recorded in table 5. The covariances of BC, BN, and CN are denoted as S2BC, S2BN, and S2CN, respectively; and are listed in table 5.

The variances of pressures calculated at even increments of pressure, the covariances of BP for even increments of pressure, and the covariances of CP at even pressure increments are recorded in table 6 under the headings S2P, S2BP, and S2CP, respectively.

Compressibility factors and standard errors of the compressibility factors calculated at even increments of pressure are listed in table 7 under the headings Z and SZ, respectively.

The detailed methods used to calculate the various constants, variances, covariances, and standard errors were discussed in reference (12). Data are recorded in tables 6 and 7 to pressures of 1,000 atmospheres. The data are recorded to 1,000 atmospheres with a full awareness of the attendant hazards involved when extrapolating data with an empirical equation beyond the range of the experimental data.

Tables 5, 6, and 7 do not conform to the Bureau of Mines Style Guide due to limitations of the computer printout; however, considerable time and money were saved by eliminating the extensive typing and proofreading that would have been required for the tables.

Values for the compressibility apparatus zero pressure volume ratio (N) for each of the twenty-two runs are recorded in table 8 along with the value of the average N, the standard error in the

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-1

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	P,OBS.-P,CAL. / P,OBS.
0	6.4728895E&02	6.4728895E&02	0.00000E-99	0.00000E-99
1	2.8125289E&02	2.8125327E&02	-3.79122E-04	-1.34797E-06
2	1.3168470E&02	1.3168271E&02	1.98702E-03	1.50892E-05
3	6.3853510E&01	6.3856222E&01	-2.71177E-03	-4.24687E-05
4	3.1491659E&01	3.1492607E&01	-9.47268E-04	-3.00799E-05
5	1.5661273E&01	1.5660585E&01	6.87580E-04	4.39032E-05
6	7.8217009E-00	7.8196732E-00	2.02770E-03	2.59240E-04
7	3.9151145E-00	3.9125240E-00	2.59048E-03	6.61662E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.36379E-05

CONSTANTS AND STANDARD ERRORS

N	1.994538449E-00	SN	1.03067E-04
B	5.278661085E-04	SB	7.50992E-07
C	-4.789121598E-08	SC	5.51862E-10

VARIANCES AND COVARIANCES

S2N	1.06228E-08
S2B	5.63989E-13
S2C	3.04552E-19
S2BC	-4.10648E-16
S2BN	-7.45204E-11
S2CN	5.23146E-14

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TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-2

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	6.9039330E&02	6.9039330E&02	0.00000E-99	0.00000E-99
1	2.9760733E&02	2.9760778E&02	-4.49502E-04	-1.51038E-06
2	1.3883415E&02	1.3883178E&02	2.36761E-03	1.70535E-05
3	6.7203083E&01	6.7206234E&01	-3.15076E-03	-4.68841E-05
4	3.3114887E&01	3.3116408E&01	-1.52041E-03	-4.59134E-05
5	1.6462213E&01	1.6460883E&01	1.33065E-03	8.08308E-05
6	8.2197040E-00	8.2173777E-00	2.32625E-03	2.83010E-04
7	4.1139611E-00	4.1109784E-00	2.98266E-03	7.25011E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 3.41250E-05

CONSTANTS AND STANDARD ERRORS

N	1.994596600E-00	SN	1.17272E-04
B	5.270983385E-04	SB	8.08440E-07
C	-4.693297998E-08	SC	5.54453E-10

VARIANCES AND COVARIANCES

S2N	1.37527E-08
S2B	6.53576E-13
S2C	3.07418E-19
S2BC	-4.44106E-16
S2BN	-9.12909E-11
S2CN	5.98045E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-3

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.0128236E&02	7.0128236E&02	0.00000E-99	0.00000E-99
1	3.0170799E&02	3.0170849E&02	-4.99133E-04	-1.65435E-06
2	1.4061376E&02	1.4061112E&02	2.64039E-03	1.87776E-05
3	6.8033559E&01	6.8037124E&01	-3.56490E-03	-5.23991E-05
4	3.3517320E&01	3.3518813E&01	-1.49289E-03	-4.45411E-05
5	1.6660572E&01	1.6659332E&01	1.23916E-03	7.43771E-05
6	8.3186011E-00	8.3161327E-00	2.46844E-03	2.96737E-04
7	4.1639855E-00	4.1603444E-00	3.64111E-03	8.74430E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 4.30445E-05

CONSTANTS AND STANDARD ERRORS

N	1.994559047E-00	SN	1.29990E-04
B	5.277062588E-04	SB	8.84365E-07
C	-4.739061450E-08	SC	5.96411E-10

VARIANCES AND COVARIANCES

S2N	1.68975E-08
S2B	7.82102E-13
S2C	3.55707E-19
S2BC	-5.22569E-16
S2BN	-1.10699E-10
S2CN	7.13077E-14

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TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-4

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.0574520E&02	7.0574520E&02	0.00000E-99	0.00000E-99
1	3.0337137E&02	3.0337184E&02	-4.69417E-04	-1.54733E-06
2	1.4133952E&02	1.4133700E&02	2.51442E-03	1.77899E-05
3	6.8373652E&01	6.8377158E&01	-3.50620E-03	-5.12800E-05
4	3.3682135E&01	3.3683467E&01	-1.33223E-03	-3.95530E-05
5	1.6741807E&01	1.6740349E&01	1.45779E-03	8.70753E-05
6	8.3590666E-00	8.3563114E-00	2.75516E-03	3.29601E-04
7	4.1826390E-00	4.1803480E-00	2.29095E-03	5.47730E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 3.55755E-05

CONSTANTS AND STANDARD ERRORS

N	1.994588585E-00	SN	1.17547E-04
B	5.271687920E-04	SB	7.95328E-07
C	-4.681194167E-08	SC	5.32730E-10

VARIANCES AND COVARIANCES

S2N	1.38173E-08
S2B	6.32546E-13
S2C	2.83801E-19
S2BC	-4.19774E-16
S2BN	-9.00258E-11
S2CN	5.75964E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-5

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	6.9787955E&02	6.9787955E&02	0.00000E-99	0.00000E-99
1	3.0041472E&02	3.0041521E&02	-4.93091E-04	-1.64136E-06
2	1.4005441E&02	1.4005180E&02	2.61096E-03	1.86425E-05
3	6.7772168E&01	6.7775718E&01	-3.55052E-03	-5.23890E-05
4	3.3390191E&01	3.3391591E&01	-1.39940E-03	-4.19105E-05
5	1.6597313E&01	1.6596132E&01	1.18110E-03	7.11626E-05
6	8.2868246E-00	8.2844129E-00	2.41166E-03	2.91024E-04
7	4.1479419E-00	4.1443432E-00	3.59864E-03	8.67573E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 4.17861E-05

CONSTANTS AND STANDARD ERRORS

N	1.994645905E-00	SN	1.28609E-04
B	5.268807189E-04	SB	8.78420E-07
C	-4.666713741E-08	SC	5.95524E-10

VARIANCES AND COVARIANCES

S2N	1.65404E-08
S2B	7.71623E-13
S2C	3.54649E-19
S2BC	-5.18287E-16
S2BN	-1.08785E-10
S2CN	7.04448E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-6

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.0298868E&02	7.0298868E&02	0.00000E-99	0.00000E-99
1	3.0233845E&02	3.0233882E&02	-3.76107E-04	-1.24399E-06
2	1.4088835E&02	1.4088639E&02	1.95427E-03	1.38710E-05
3	6.8163698E&01	6.8166160E&01	-2.46256E-03	-3.61272E-05
4	3.3579834E&01	3.3581280E&01	-1.44524E-03	-4.30390E-05
5	1.6690781E&01	1.6690040E&01	7.40724E-04	4.43792E-05
6	8.3334615E-00	8.3313413E-00	2.12015E-03	2.54414E-04
7	4.1709998E-00	4.1679046E-00	3.09523E-03	7.42083E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.67377E-05

CONSTANTS AND STANDARD ERRORS

N	1.994576605E-00	SN	1.02241E-04
B	5.274084928E-04	SB	6.94109E-07
C	-4.703667006E-08	SC	4.66884E-10

VARIANCES AND COVARIANCES

S2N	1.04532E-08
S2B	4.81787E-13
S2C	2.17981E-19
S2BC	-3.21071E-16
S2BN	-6.83373E-11
S2CN	4.39047E-14

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TABLE 5. - EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-7

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.0208680E&02	7.0208680E&02	0.00000E-99	0.00000E-99
1	3.0200812E&02	3.0200852E&02	-4.00933E-04	-1.32756E-06
2	1.4074887E&02	1.4074672E&02	2.15122E-03	1.52841E-05
3	6.8097837E&01	6.8100872E&01	-3.03519E-03	-4.45710E-05
4	3.3548005E&01	3.3549042E&01	-1.03785E-03	-3.09365E-05
5	1.6674984E&01	1.6673677E&01	1.30695E-03	7.83782E-05
6	8.3248260E-00	8.3229256E-00	1.90033E-03	2.28273E-04
7	4.1658969E-00	4.1635510E-00	2.34587E-03	5.63113E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.59005E-05

CONSTANTS AND STANDARD ERRORS

N	1.994655145E-00	SN	1.00737E-04
B	5.267277664E-04	SB	6.84502E-07
C	-4.664661038E-08	SC	4.61088E-10

VARIANCES AND COVARIANCES

S2N	1.01480E-08
S2B	4.68544E-13
S2C	2.12602E-19
S2BC	-3.12698E-16
S2BN	-6.63999E-11
S2CN	4.27218E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-8

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.0061130E&02	7.0061130E&02	0.00000E-99	0.00000E-99
1	3.0144846E&02	3.0144894E&02	-4.85326E-04	-1.60998E-06
2	1.4050824E&02	1.4050564E&02	2.60068E-03	1.85091E-05
3	6.7985497E&01	6.7989157E&01	-3.65961E-03	-5.38293E-05
4	3.3494053E&01	3.3495302E&01	-1.24887E-03	-3.72863E-05
5	1.6648795E&01	1.6647332E&01	1.46235E-03	8.78357E-05
6	8.3123743E-00	8.3098882E-00	2.48615E-03	2.99091E-04
7	4.1598289E-00	4.1570683E-00	2.76066E-03	6.63649E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 3.78923E-05

CONSTANTS AND STANDARD ERRORS

N	1.994644503E-00	SN	1.22061E-04
B	5.265546450E-04	SB	8.30873E-07
C	-4.642499200E-08	SC	5.60943E-10

VARIANCES AND COVARIANCES

S2N	1.48989E-08
S2B	6.90350E-13
S2C	3.14657E-19
S2BC	-4.61764E-16
S2BN	-9.76587E-11
S2CN	6.29753E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-9

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	6.8457479E&02	6.8457479E&02	0.00000E-99	0.00000E-99
1	2.9540775E&02	2.9540786E&02	-1.07909E-04	-3.65290E-07
2	1.3787047E&02	1.3786989E&02	5.80596E-04	4.21117E-06
3	6.6752988E&01	6.6753938E&01	-9.49597E-04	-1.42255E-05
4	3.2896560E&01	3.2896021E&01	5.38243E-04	1.63616E-05
5	1.6350585E&01	1.6351594E&01	-1.00854E-03	-6.16826E-05
6	8.1629533E-00	8.1627075E-00	2.45852E-04	3.01180E-05
7	4.0856389E-00	4.0835117E-00	2.12721E-03	5.20655E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 7.14282E-06

CONSTANTS AND STANDARD ERRORS

N	1.994683005E-00	SN	5.40394E-05
B	5.269346921E-04	SB	3.75194E-07
C	-4.692110033E-08	SC	2.59678E-10

VARIANCES AND COVARIANCES

S2N	2.92026E-09
S2B	1.40770E-13
S2C	6.74327E-20
S2BC	-9.65316E-17
S2BN	-1.95227E-11
S2CN	1.29067E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-10

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	P,OBS.-P,CAL. / P,OBS.
0	7.0727559E&02	7.0727559E&02	0.00000E-99	0.00000E-99
1	3.0394992E&02	3.0395032E&02	-4.03419E-04	-1.32725E-06
2	1.4159267E&02	1.4159044E&02	2.23308E-03	1.57711E-05
3	6.8490921E&01	6.8494449E&01	-3.52876E-03	-5.15216E-05
4	3.3738977E&01	3.3738994E&01	-1.64789E-05	-4.88423E-07
5	1.6767501E&01	1.6766889E&01	6.12244E-04	3.65137E-05
6	8.3712273E-00	8.3690432E-00	2.18409E-03	2.60905E-04
7	4.1883028E-00	4.1864612E-00	1.84157E-03	4.39694E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.61383E-05

CONSTANTS AND STANDARD ERRORS

N	1.994710232E-00	SN	1.00580E-04
B	5.263776675E-04	SB	6.79091E-07
C	-4.634771206E-08	SC	4.53855E-10

VARIANCES AND COVARIANCES

S2N	1.01163E-08
S2B	4.61165E-13
S2C	2.05984E-19
S2BC	-3.05356E-16
S2BN	-6.57731E-11
S2CN	4.19859E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-11

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.0340360E&02	7.0340360E&02	0.00000E-99	0.00000E-99
1	3.0249876E&02	3.0249920E&02	-4.37554E-04	-1.44646E-06
2	1.4096179E&02	1.4095944E&02	2.35324E-03	1.66941E-05
3	6.8196393E&01	6.8199749E&01	-3.35541E-03	-4.92022E-05
4	3.3595563E&01	3.3596541E&01	-9.78234E-04	-2.91179E-05
5	1.6697915E&01	1.6696861E&01	1.05400E-03	6.31218E-05
6	8.3369834E-00	8.3343296E-00	2.65375E-03	3.18311E-04
7	4.1713507E-00	4.1691820E-00	2.16873E-03	5.19912E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 3.08017E-05

CONSTANTS AND STANDARD ERRORS

N	1.994685709E-00	SN	1.09688E-04
B	5.265805061E-04	SB	7.44096E-07
C	-4.652236204E-08	SC	5.00230E-10

VARIANCES AND COVARIANCES

S2N	1.20315E-08
S2B	5.53679E-13
S2C	2.50230E-19
S2BC	-3.68777E-16
S2BN	-7.85947E-11
S2CN	5.04668E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-12

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	6.9905324E&02	6.9905324E&02	0.00000E-99	0.00000E-99
1	3.0086678E&02	3.0086714E&02	-3.62422E-04	-1.20459E-06
2	1.4025209E&02	1.4025013E&02	1.96740E-03	1.40276E-05
3	6.7865373E&01	6.7868316E&01	-2.94273E-03	-4.33613E-05
4	3.3435772E&01	3.3436121E&01	-3.48478E-04	-1.04223E-05
5	1.6618379E&01	1.6617855E&01	5.24250E-04	3.15464E-05
6	8.2969111E-00	8.2950839E-00	1.82711E-03	2.20216E-04
7	4.1518777E-00	4.1496029E-00	2.27487E-03	5.47913E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.15713E-05

CONSTANTS AND STANDARD ERRORS

N	1.994680156E-00	SN	9.22708E-05
B	5.266261530E-04	SB	6.29262E-07
C	-4.659835926E-08	SC	4.25857E-10

VARIANCES AND COVARIANCES

S2N	8.51390E-09
S2B	3.95971E-13
S2C	1.81354E-19
S2BC	-2.65499E-16
S2BN	-5.59103E-11
S2CN	3.61412E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-13

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.1102445E&02	7.1102445E&02	0.00000E-99	0.00000E-99
1	3.0535233E&02	3.0535038E&02	1.94953E-03	6.38453E-06
2	1.4213544E&02	1.4214662E&02	-1.11743E-02	-7.86177E-05
3	6.8777416E&01	6.8758200E&01	1.92156E-02	2.79388E-04
4	3.3877134E&01	3.3879038E&01	-1.90374E-03	-5.61956E-05
5	1.6837357E&01	1.6844952E&01	-7.59531E-03	-4.51099E-04
6	8.4059564E-00	8.4131355E-00	-7.17913E-03	-8.54053E-04
7	4.2075898E-00	4.2113178E-00	-3.72805E-03	-8.86031E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 6.24658E-04

CONSTANTS AND STANDARD ERRORS

N	1.993265919E-00	SN	4.88935E-04
B	5.382623171E-04	SB	3.29837E-06
C	-5.442672437E-08	SC	2.18990E-09

VARIANCES AND COVARIANCES

S2N	2.39057E-07
S2B	1.08792E-11
S2C	4.79567E-18
S2BC	-7.15613E-15
S2BN	-1.55300E-09
S2CN	9.84790E-13

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-14

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.) / P,OBS.
0	6.9853895E&02	6.9853895E&02	0.00000E-99	0.00000E-99
1	3.0067567E&02	3.0067608E&02	-4.09132E-04	-1.36071E-06
2	1.4016953E&02	1.4016736E&02	2.17003E-03	1.54814E-05
3	6.7826865E&01	6.7829815E&01	-2.94984E-03	-4.34907E-05
4	3.3416347E&01	3.3417597E&01	-1.25043E-03	-3.74197E-05
5	1.6609979E&01	1.6608796E&01	1.18318E-03	7.12335E-05
6	8.2927140E-00	8.2906178E-00	2.09628E-03	2.52786E-04
7	4.1500376E-00	4.1473923E-00	2.64529E-03	6.37414E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.79335E-05

CONSTANTS AND STANDARD ERRORS

N	1.994670786E-00	SN	1.05064E-04
B	5.266671438E-04	SB	7.16971E-07
C	-4.664502570E-08	SC	4.85596E-10

VARIANCES AND COVARIANCES

S2N	1.10386E-08
S2B	5.14047E-13
S2C	2.35804E-19
S2BC	-3.44941E-16
S2BN	-7.25362E-11
S2CN	4.69253E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-15

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.) / P,OBS.
0	7.0725396E&02	7.0725396E&02	0.00000E-99	0.00000E-99
1	3.0393974E&02	3.0394014E&02	-3.99883E-04	-1.31566E-06
2	1.4158487E&02	1.4158273E&02	2.14237E-03	1.51314E-05
3	6.8487098E&01	6.8490121E&01	-3.02290E-03	-4.41382E-05
4	3.3735978E&01	3.3736872E&01	-8.94679E-04	-2.65200E-05
5	1.6766788E&01	1.6765924E&01	8.63908E-04	5.15249E-05
6	8.3707330E-00	8.3686287E-00	2.10421E-03	2.51377E-04
7	4.1888843E-00	4.1862931E-00	2.59111E-03	6.18568E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.65760E-05

CONSTANTS AND STANDARD ERRORS

N	1.994688638E-00	SN	1.01424E-04
B	5.267589460E-04	SB	6.84869E-07
C	-4.663276458E-08	SC	4.57721E-10

VARIANCES AND COVARIANCES

S2N	1.02868E-08
S2B	4.69046E-13
S2C	2.09508E-19
S2BC	-3.10578E-16
S2BN	-6.68896E-11
S2CN	4.26991E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-16

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	P,OBS.-P,CAL. / P,OBS.
0	7.0575241E&02	7.0575241E&02	0.00000E-99	0.00000E-99
1	3.0337578E&02	3.0337616E&02	-3.71762E-04	-1.22542E-06
2	1.4134198E&02	1.4133997E&02	2.01183E-03	1.42338E-05
3	6.8374213E&01	6.8377126E&01	-2.91304E-03	-4.26043E-05
4	3.3681291E&01	3.3682113E&01	-8.21297E-04	-2.43843E-05
5	1.6740047E&01	1.6738841E&01	1.20600E-03	7.20432E-05
6	8.3570058E-00	8.3550967E-00	1.90902E-03	2.28433E-04
7	4.1813150E-00	4.1794973E-00	1.81770E-03	4.34719E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.17488E-05

CONSTANTS AND STANDARD ERRORS

N	1.994710856E-00	SN	9.19145E-05
B	5.264497762E-04	SB	6.21732E-07
C	-4.639217186E-08	SC	4.16480E-10

VARIANCES AND COVARIANCES

S2N	8.44827E-09
S2B	3.86551E-13
S2C	1.73456E-19
S2BC	-2.56543E-16
S2BN	-5.50292E-11
S2CN	3.52089E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-17

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	6.9911233E&02	6.9911233E&02	0.00000E-99	0.00000E-99
1	3.0088594E&02	3.0088631E&02	-3.61951E-04	-1.20295E-06
2	1.4025861E&02	1.4025663E&02	1.97521E-03	1.40826E-05
3	6.7867489E&01	6.7870445E&01	-2.95621E-03	-4.35586E-05
4	3.3436121E&01	3.3436701E&01	-5.80289E-04	-1.73551E-05
5	1.6619056E&01	1.6617918E&01	1.13865E-03	6.85147E-05
6	8.2968869E-00	8.2950036E-00	1.88329E-03	2.26988E-04
7	4.1510115E-00	4.1495070E-00	1.50450E-03	3.62443E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.02152E-05

CONSTANTS AND STANDARD ERRORS

N	1.994706908E-00	SN	8.93209E-05
B	5.266221013E-04	SB	6.09085E-07
C	-4.661046145E-08	SC	4.12169E-10

VARIANCES AND COVARIANCES

S2N	7.97823E-09
S2B	3.70985E-13
S2C	1.69883E-19
S2BC	-2.48726E-16
S2BN	-5.23875E-11
S2CN	3.38612E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-18

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.0498797E&02	7.0498797E&02	0.00000E-99	0.00000E-99
1	3.0309166E&02	3.0309198E&02	-3.14871E-04	-1.03886E-06
2	1.4121823E&02	1.4121650E&02	1.73309E-03	1.22724E-05
3	6.8316532E&01	6.8319147E&01	-2.61551E-03	-3.82852E-05
4	3.3653188E&01	3.3653831E&01	-6.43610E-04	-1.91248E-05
5	1.6726144E&01	1.6724785E&01	1.35891E-03	8.12446E-05
6	8.3501239E-00	8.3480459E-00	2.07799E-03	2.48858E-04
7	4.1762502E-00	4.1759443E-00	3.05880E-04	7.32428E-05

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 1.66161E-05

CONSTANTS AND STANDARD ERRORS

N	1.994727420E-00	SN	8.04122E-05
B	5.263874634E-04	SB	5.44413E-07
C	-4.639439499E-08	SC	3.65117E-10

VARIANCES AND COVARIANCES

S2N	6.46612E-09
S2B	2.96385E-13
S2C	1.33310E-19
S2BC	-1.96935E-16
S2BN	-4.21555E-11
S2CN	2.70039E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-19

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	P,OBS.-P,CAL. / P,OBS.
0	6.9586241E&02	6.9586241E&02	0.00000E-99	0.00000E-99
1	2.9965869E&02	2.9965909E&02	-4.06652E-04	-1.35705E-06
2	1.3972241E&02	1.3972019E&02	2.21898E-03	1.58814E-05
3	6.7615486E&01	6.7618841E&01	-3.35508E-03	-4.96201E-05
4	3.3314160E&01	3.3314617E&01	-4.57125E-04	-1.37216E-05
5	1.6558741E&01	1.6557686E&01	1.05532E-03	6.37322E-05
6	8.2667975E-00	8.2650413E-00	1.75617E-03	2.12436E-04
7	4.1368299E-00	4.1345410E-00	2.28883E-03	5.53282E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.59914E-05

CONSTANTS AND STANDARD ERRORS

N	1.994710157E-00	SN	1.01684E-04
B	5.268100445E-04	SB	6.96171E-07
C	-4.675419052E-08	SC	4.73455E-10

VARIANCES AND COVARIANCES

S2N	1.03396E-08
S2B	4.84654E-13
S2C	2.24160E-19
S2BC	-3.26562E-16
S2BN	-6.81649E-11
S2CN	4.42799E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-20

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	6.8620552E&02	6.8620552E&02	0.00000E-99	0.00000E-99
1	2.9602082E&02	2.9602117E&02	-3.52509E-04	-1.19082E-06
2	1.3813812E&02	1.3813622E&02	1.89427E-03	1.37128E-05
3	6.6875363E&01	6.6878096E&01	-2.73275E-03	-4.08634E-05
4	3.2955262E&01	3.2955934E&01	-6.72314E-04	-2.04008E-05
5	1.6381782E&01	1.6381001E&01	7.81703E-04	4.77178E-05
6	8.1792899E-00	8.1772633E-00	2.02653E-03	2.47764E-04
7	4.0925711E-00	4.0907469E-00	1.82414E-03	4.45721E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 1.96779E-05

CONSTANTS AND STANDARD ERRORS

N	1.994698264E-00	SN	8.95215E-05
B	5.269146986E-04	SB	6.20268E-07
C	-4.689610231E-08	SC	4.28203E-10

VARIANCES AND COVARIANCES

S2N	8.01410E-09
S2B	3.84733E-13
S2C	1.83358E-19
S2BC	-2.63152E-16
S2BN	-5.34668E-11
S2CN	3.52575E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-21

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	7.7435393E&02	7.7435393E&02	0.00000E-99	0.00000E-99
1	3.2882507E&02	3.2882548E&02	-4.09534E-04	-1.24544E-06
2	1.5234062E&02	1.5233842E&02	2.19859E-03	1.44320E-05
3	7.3499612E&01	7.3502566E&01	-2.95333E-03	-4.01815E-05
4	3.6158408E&01	3.6159824E&01	-1.41660E-03	-3.91778E-05
5	1.7959522E&01	1.7958392E&01	1.12999E-03	6.29191E-05
6	8.9632908E-00	8.9607633E-00	2.52756E-03	2.81990E-04
7	4.4841902E-00	4.4816345E-00	2.55574E-03	5.69945E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 2.99278E-05

CONSTANTS AND STANDARD ERRORS

N	1.994775574E-00	SN	9.98009E-05
B	5.256600758E-04	SB	6.24062E-07
C	-4.540294049E-08	SC	3.78373E-10

VARIANCES AND COVARIANCES

S2N	9.96023E-09
S2B	3.89454E-13
S2C	1.43166E-19
S2BC	-2.33919E-16
S2BN	-5.99887E-11
S2CN	3.47328E-14

TABLE 5.- EXPERIMENTAL PRESSURES, CALCULATED PRESSURES, CONSTANTS, STANDARD ERRORS, VARIANCES, AND COVARIANCES

RUN NO. HE-0-22

R	P,OBS.,ATM.	P,CAL.,ATM.	P,OBS.-P,CAL.	(P,OBS.-P,CAL.)/P,OBS.
0	5.8218590E&02	5.8218590E&02	0.00000E-99	0.00000E-99
1	2.5608357E&02	2.5608380E&02	-2.29970E-04	-8.98029E-07
2	1.2058177E&02	1.2058057E&02	1.20867E-03	1.00236E-05
3	5.8627782E&01	5.8629522E&01	-1.73926E-03	-2.96662E-05
4	2.8951908E&01	2.8952293E&01	-3.85149E-04	-1.33030E-05
5	1.4406838E&01	1.4406347E&01	4.90996E-04	3.40808E-05
6	7.1967975E-00	7.1955494E-00	1.24802E-03	1.73414E-04
7	3.6018337E-00	3.6007376E-00	1.09616E-03	3.04333E-04

SUM OF WEIGHTED SQUARES OF THE RESIDUALS 7.68737E-06

CONSTANTS AND STANDARD ERRORS

N	1.994589770E-00	SN	6.43602E-05
B	5.282209668E-04	SB	5.14062E-07
C	-4.863993404E-08	SC	4.23031E-10

VARIANCES AND COVARIANCES

S2N	4.14224E-09
S2B	2.64260E-13
S2C	1.78955E-19
S2BC	-2.15496E-16
S2BN	-3.18457E-11
S2CN	2.50415E-14

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-1

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	7.46782E-08	1.89899E-10	-1.31276E-13
2.000E-00	1.98296E-07	3.06081E-10	-2.10827E-13
5.000E-00	6.19199E-07	5.26663E-10	-3.59812E-13
1.000E&01	1.22174E-06	7.08251E-10	-4.78046E-13
2.500E&01	1.97179E-06	7.44240E-10	-4.79476E-13
5.000E&01	1.92651E-06	2.76111E-10	-1.23385E-13
7.500E&01	2.32259E-06	-3.02286E-10	2.96096E-13
1.000E&02	3.35699E-06	-7.95151E-10	6.43033E-13
1.250E&02	4.46108E-06	-1.13251E-09	8.69832E-13
1.500E&02	5.11675E-06	-1.29051E-09	9.61261E-13
2.000E&02	4.66506E-06	-1.07357E-09	7.47750E-13
2.500E&02	4.18409E-06	-2.50828E-10	8.94928E-14
3.000E&02	8.10615E-06	9.84031E-10	-8.65347E-13
3.500E&02	1.91595E-05	2.39695E-09	-1.94031E-12
4.000E&02	3.56562E-05	3.73286E-09	-2.94427E-12
4.500E&02	5.10273E-05	4.72525E-09	-3.67819E-12
5.000E&02	5.60166E-05	5.10176E-09	-3.93904E-12
6.000E&02	1.71247E-05	2.90787E-09	-2.22342E-12
7.000E&02	4.98722E-05	-5.03746E-09	3.82983E-12
8.000E&02	8.41450E-04	-2.08755E-08	1.58109E-11
9.000E&02	4.15656E-03	-4.66667E-08	3.52487E-11
1.000E&03	1.34746E-02	-8.43664E-08	6.35933E-11

TABLE 6. - VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-2

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	9.95049E-08	2.36203E-10	-1.52400E-13
2.000E-00	2.65831E-07	3.82034E-10	-2.45627E-13
5.000E-00	8.40598E-07	6.62358E-10	-4.22522E-13
1.000E&01	1.68501E-06	9.00285E-10	-5.67722E-13
2.500E&01	2.81845E-06	9.80918E-10	-5.92770E-13
5.000E&01	2.78692E-06	4.38016E-10	-2.04151E-13
7.500E&01	3.18659E-06	-2.73125E-10	2.79354E-13
1.000E&02	4.49544E-06	-9.07118E-10	6.98532E-13
1.250E&02	6.07452E-06	-1.37272E-09	9.95155E-13
1.500E&02	7.21926E-06	-1.63515E-09	1.14798E-12
2.000E&02	7.13161E-06	-1.53475E-09	1.01813E-12
2.500E&02	5.88843E-06	-6.92232E-10	3.77899E-13
3.000E&02	8.78845E-06	6.99102E-10	-6.33702E-13
3.500E&02	2.04068E-05	2.39617E-09	-1.84511E-12
4.000E&02	4.10249E-05	4.12970E-09	-3.06767E-12
4.500E&02	6.51029E-05	5.61592E-09	-4.10335E-12
5.000E&02	8.23239E-05	6.56318E-09	-4.74907E-12
6.000E&02	5.67960E-05	5.65843E-09	-4.04880E-12
7.000E&02	1.53375E-06	-9.46453E-10	6.72906E-13
8.000E&02	4.06824E-04	-1.55720E-08	1.10250E-11
9.000E&02	2.71044E-03	-4.04593E-08	2.85601E-11
1.000E&03	9.91610E-03	-7.77423E-08	5.47555E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-3

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	1.23112E-07	2.87476E-10	-1.82392E-13
2.000E-00	3.29369E-07	4.65343E-10	-2.94213E-13
5.000E-00	1.04460E-06	8.08234E-10	-5.07034E-13
1.000E&01	2.10172E-06	1.10129E-09	-6.83069E-13
2.500E&01	3.54524E-06	1.20992E-09	-7.19774E-13
5.000E&01	3.51873E-06	5.61070E-10	-2.62065E-13
7.500E&01	3.97544E-06	-3.01240E-10	3.15070E-13
1.000E&02	5.56874E-06	-1.07795E-09	8.20778E-13
1.250E&02	7.54629E-06	-1.65695E-09	1.18461E-12
1.500E&02	9.03797E-06	-1.99455E-09	1.38024E-12
2.000E&02	9.10348E-06	-1.92047E-09	1.25786E-12
2.500E&02	7.45861E-06	-9.48426E-10	5.27721E-13
3.000E&02	1.04279E-05	6.99089E-10	-6.52553E-13
3.500E&02	2.38365E-05	2.73918E-09	-2.08645E-12
4.000E&02	4.86554E-05	4.85710E-09	-3.55703E-12
4.500E&02	7.89406E-05	6.72042E-09	-4.83609E-12
5.000E&02	1.02707E-04	7.98704E-09	-5.68935E-12
6.000E&02	8.02312E-05	7.34186E-09	-5.16941E-12
7.000E&02	3.09030E-08	1.46772E-10	-1.02665E-13
8.000E&02	3.74376E-04	-1.63260E-08	1.13709E-11
9.000E&02	2.77004E-03	-4.47113E-08	3.10462E-11
1.000E&03	1.05137E-02	-8.75182E-08	6.06315E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-4

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	1.00947E-07	2.34127E-10	-1.47537E-13
2.000E-00	2.70229E-07	3.79112E-10	-2.38070E-13
5.000E-00	8.58072E-07	6.58937E-10	-4.10587E-13
1.000E&01	1.72902E-06	8.98767E-10	-5.53723E-13
2.500E&01	2.92659E-06	9.90695E-10	-5.85617E-13
5.000E&01	2.90944E-06	4.66189E-10	-2.17798E-13
7.500E&01	3.27149E-06	-2.35011E-10	2.48529E-13
1.000E&02	4.56893E-06	-8.69216E-10	6.58883E-13
1.250E&02	6.19773E-06	-1.34474E-09	9.56032E-13
1.500E&02	7.44537E-06	-1.62560E-09	1.11837E-12
2.000E&02	7.55811E-06	-1.58091E-09	1.03005E-12
2.500E&02	6.18019E-06	-8.06653E-10	4.51111E-13
3.000E&02	8.41929E-06	5.20103E-10	-4.93726E-13
3.500E&02	1.90995E-05	2.17313E-09	-1.64832E-12
4.000E&02	3.92142E-05	3.90024E-09	-2.84001E-12
4.500E&02	6.41835E-05	5.43479E-09	-3.88696E-12
5.000E&02	8.44427E-05	6.50222E-09	-4.60238E-12
6.000E&02	6.90575E-05	6.12066E-09	-4.28157E-12
7.000E&02	4.90871E-07	5.25800E-10	-3.65373E-13
8.000E&02	2.70513E-04	-1.24761E-08	8.63201E-12
9.000E&02	2.10058E-03	-3.50058E-08	2.41455E-11
1.000E&03	8.10367E-03	-6.90846E-08	4.75421E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-5

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	1.20232E-07	2.82162E-10	-1.79962E-13
2.000E-00	3.21524E-07	4.56627E-10	-2.90219E-13
5.000E-00	1.01879E-06	7.92660E-10	-4.99867E-13
1.000E&01	2.04747E-06	1.07924E-09	-6.72869E-13
2.500E&01	3.44476E-06	1.18267E-09	-7.07028E-13
5.000E&01	3.41493E-06	5.42160E-10	-2.53129E-13
7.500E&01	3.87239E-06	-3.05246E-10	3.16825E-13
1.000E&02	5.43660E-06	-1.06612E-09	8.14606E-13
1.250E&02	7.36111E-06	-1.63072E-09	1.17093E-12
1.500E&02	8.79534E-06	-1.95658E-09	1.36008E-12
2.000E&02	8.80563E-06	-1.86920E-09	1.22920E-12
2.500E&02	7.22867E-06	-8.98676E-10	4.97595E-13
3.000E&02	1.03148E-05	7.32790E-10	-6.76579E-13
3.500E&02	2.37096E-05	2.74362E-09	-2.09675E-12
4.000E&02	4.81795E-05	4.82094E-09	-3.54618E-12
4.500E&02	7.76454E-05	6.63450E-09	-4.79698E-12
5.000E&02	1.00156E-04	7.84455E-09	-5.61526E-12
6.000E&02	7.54254E-05	7.07549E-09	-5.00696E-12
7.000E&02	8.49343E-08	-2.41792E-10	1.69992E-13
8.000E&02	4.02371E-04	-1.68169E-08	1.17728E-11
9.000E&02	2.87665E-03	-4.52682E-08	3.15948E-11
1.000E&03	1.07921E-02	-8.80911E-08	6.13436E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-6

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	7.62393E-08	1.77562E-10	-1.12362E-13
2.000E-00	2.04013E-07	2.87459E-10	-1.81272E-13
5.000E-00	6.47332E-07	4.99412E-10	-3.12486E-13
1.000E&01	1.30317E-06	6.80758E-10	-4.21146E-13
2.500E&01	2.20112E-06	7.48848E-10	-4.44395E-13
5.000E&01	2.18604E-06	3.49207E-10	-1.63119E-13
7.500E&01	2.46534E-06	-1.83105E-10	1.92282E-13
1.000E&02	3.44950E-06	-6.63334E-10	5.04203E-13
1.250E&02	4.67632E-06	-1.02211E-09	7.29175E-13
1.500E&02	5.60719E-06	-1.23235E-09	8.50886E-13
2.000E&02	5.66464E-06	-1.19111E-09	7.78588E-13
2.500E&02	4.63726E-06	-5.95719E-10	3.32145E-13
3.000E&02	6.41970E-06	4.17613E-10	-3.92142E-13
3.500E&02	1.46339E-05	1.67536E-09	-1.27404E-12
4.000E&02	2.99390E-05	2.98432E-09	-2.18072E-12
4.500E&02	4.87392E-05	4.14034E-09	-2.97241E-12
5.000E&02	6.36869E-05	4.93329E-09	-3.50555E-12
6.000E&02	5.06470E-05	4.57693E-09	-3.21458E-12
7.000E&02	1.02569E-07	2.09829E-10	-1.46401E-13
8.000E&02	2.21065E-04	-9.84523E-09	6.83965E-12
9.000E&02	1.66559E-03	-2.72089E-08	1.88448E-11
1.000E&03	6.36111E-03	-5.34255E-08	3.69177E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-7

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	7.39618E-08	1.72465E-10	-1.09294E-13
2.000E-00	1.97898E-07	2.79191E-10	-1.76312E-13
5.000E-00	6.27791E-07	4.84982E-10	-3.03893E-13
1.000E&01	1.26348E-06	6.60962E-10	-4.09484E-13
2.500E&01	2.13272E-06	7.26611E-10	-4.31787E-13
5.000E&01	2.11749E-06	3.37875E-10	-1.57840E-13
7.500E&01	2.39020E-06	-1.79325E-10	1.87940E-13
1.000E&02	3.34623E-06	-6.45551E-10	4.91170E-13
1.250E&02	4.53538E-06	-9.93472E-10	7.09596E-13
1.500E&02	5.43494E-06	-1.19683E-09	8.27393E-13
2.000E&02	5.48222E-06	-1.15450E-09	7.55510E-13
2.500E&02	4.48982E-06	-5.73628E-10	3.19518E-13
3.000E&02	6.24786E-06	4.12895E-10	-3.86506E-13
3.500E&02	1.42639E-05	1.63591E-09	-1.24519E-12
4.000E&02	2.91494E-05	2.90714E-09	-2.12693E-12
4.500E&02	4.73725E-05	4.02767E-09	-2.89531E-12
5.000E&02	6.17654E-05	4.79274E-09	-3.41026E-12
6.000E&02	4.86670E-05	4.42528E-09	-3.11236E-12
7.000E&02	4.88890E-08	1.42876E-10	-9.98272E-14
8.000E&02	2.20131E-04	-9.68927E-09	6.74077E-12
9.000E&02	1.64297E-03	-2.66513E-08	1.84847E-11
1.000E&03	6.25544E-03	-5.22496E-08	3.61562E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-8

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	1.08490E-07	2.53536E-10	-1.61031E-13
2.000E-00	2.90231E-07	4.10386E-10	-2.59745E-13
5.000E-00	9.20334E-07	7.12712E-10	-4.47588E-13
1.000E&01	1.85133E-06	9.71006E-10	-6.02897E-13
2.500E&01	3.12145E-06	1.06627E-09	-6.34962E-13
5.000E&01	3.09747E-06	4.93391E-10	-2.30457E-13
7.500E&01	3.50187E-06	-2.67327E-10	2.79198E-13
1.000E&02	4.90739E-06	-9.52131E-10	7.25504E-13
1.250E&02	6.64903E-06	-1.46216E-09	1.04629E-12
1.500E&02	7.95976E-06	-1.75898E-09	1.21835E-12
2.000E&02	8.00807E-06	-1.69108E-09	1.10854E-12
2.500E&02	6.56343E-06	-8.30789E-10	4.61855E-13
3.000E&02	9.21403E-06	6.25032E-10	-5.82080E-13
3.500E&02	2.10884E-05	2.42620E-09	-1.84931E-12
4.000E&02	4.30132E-05	4.29443E-09	-3.14781E-12
4.500E&02	6.97015E-05	5.93577E-09	-4.27560E-12
5.000E&02	9.05431E-05	7.04768E-09	-5.02525E-12
6.000E&02	7.02437E-05	6.45524E-09	-4.54981E-12
7.000E&02	6.23026E-09	6.19225E-11	-4.33589E-14
8.000E&02	3.36701E-04	-1.45475E-08	1.01427E-11
9.000E&02	2.47480E-03	-3.97080E-08	2.76010E-11
1.000E&03	9.37419E-03	-7.76456E-08	5.38484E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-9

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	2.10452E-08	5.04067E-11	-3.28206E-14
2.000E-00	5.61791E-08	8.14912E-11	-5.28734E-14
5.000E-00	1.77359E-07	1.41148E-10	-9.08588E-14
1.000E&01	3.54803E-07	1.91587E-10	-1.21906E-13
2.500E&01	5.90743E-07	2.07790E-10	-1.26638E-13
5.000E&01	5.83068E-07	9.08019E-11	-4.22254E-14
7.500E&01	6.71179E-07	-6.12471E-11	6.20392E-14
1.000E&02	9.50332E-07	-1.96031E-10	1.51900E-13
1.250E&02	1.28189E-06	-2.94188E-10	2.14894E-13
1.500E&02	1.51684E-06	-3.48427E-10	2.46543E-13
2.000E&02	1.48262E-06	-3.22367E-10	2.15314E-13
2.500E&02	1.23154E-06	-1.37482E-10	7.39080E-14
3.000E&02	1.90461E-06	1.63722E-10	-1.46863E-13
3.500E&02	4.45123E-06	5.28108E-10	-4.09167E-13
4.000E&02	8.86933E-06	8.96943E-10	-6.71492E-13
4.500E&02	1.39009E-05	1.20840E-09	-8.90304E-13
5.000E&02	1.72949E-05	1.39901E-09	-1.02099E-12
6.000E&02	1.10665E-05	1.16041E-09	-8.37614E-13
7.000E&02	8.77794E-07	-3.32519E-10	2.38514E-13
8.000E&02	9.99697E-05	-3.58421E-09	2.56033E-12
9.000E&02	6.33566E-04	-9.08162E-09	6.46825E-12
1.000E&03	2.27538E-03	-1.72883E-08	1.22861E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-10

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	7.39614E-08	1.71119E-10	-1.07591E-13
2.000E-00	1.98031E-07	2.77118E-10	-1.73633E-13
5.000E-00	6.29089E-07	4.81785E-10	-2.99536E-13
1.000E&01	1.26830E-06	6.57369E-10	-4.04108E-13
2.500E&01	2.14937E-06	7.25445E-10	-4.27931E-13
5.000E&01	2.13807E-06	3.43093E-10	-1.60316E-13
7.500E&01	2.40019E-06	-1.69132E-10	1.79625E-13
1.000E&02	3.34846E-06	-6.33081E-10	4.79203E-13
1.250E&02	4.54366E-06	-9.81652E-10	6.96621E-13
1.500E&02	5.46399E-06	-1.18842E-09	8.16048E-13
2.000E&02	5.56175E-06	-1.15971E-09	7.54329E-13
2.500E&02	4.54530E-06	-5.98206E-10	3.35076E-13
3.000E&02	6.13696E-06	3.67723E-10	-3.51461E-13
3.500E&02	1.38829E-05	1.57376E-09	-1.19212E-12
4.000E&02	2.85600E-05	2.83663E-09	-2.06168E-12
4.500E&02	4.68862E-05	3.96244E-09	-2.82822E-12
5.000E&02	6.19198E-05	4.75149E-09	-3.35618E-12
6.000E&02	5.14133E-05	4.50809E-09	-3.14678E-12
7.000E&02	5.69966E-07	4.83694E-10	-3.35384E-13
8.000E&02	1.89669E-04	-8.91901E-09	6.15741E-12
9.000E&02	1.49871E-03	-2.52449E-08	1.73746E-11
1.000E&03	5.81553E-03	-4.99675E-08	3.43105E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-11

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	8.77556E-08	2.04221E-10	-1.29160E-13
2.000E-00	2.34847E-07	3.30631E-10	-2.08381E-13
5.000E-00	7.45267E-07	5.74461E-10	-3.59248E-13
1.000E&01	1.50058E-06	7.83143E-10	-4.84224E-13
2.500E&01	2.53549E-06	8.61774E-10	-5.11153E-13
5.000E&01	2.51856E-06	4.02475E-10	-1.88040E-13
7.500E&01	2.83890E-06	-2.09678E-10	2.20457E-13
1.000E&02	3.97092E-06	-7.62171E-10	5.79137E-13
1.250E&02	5.38372E-06	-1.17518E-09	8.38002E-13
1.500E&02	6.45736E-06	-1.41751E-09	9.78273E-13
2.000E&02	6.52857E-06	-1.37143E-09	8.96090E-13
2.500E&02	5.34341E-06	-6.88089E-10	3.83879E-13
3.000E&02	7.37873E-06	4.76205E-10	-4.47910E-13
3.500E&02	1.68087E-05	1.92223E-09	-1.46130E-12
4.000E&02	3.44095E-05	3.42810E-09	-2.50386E-12
4.500E&02	5.60666E-05	4.75936E-09	-3.41509E-12
5.000E&02	7.33426E-05	5.67456E-09	-4.03019E-12
6.000E&02	5.85836E-05	5.27668E-09	-3.70405E-12
7.000E&02	1.52691E-07	2.74443E-10	-1.91380E-13
8.000E&02	2.51655E-04	-1.12606E-08	7.81866E-12
9.000E&02	1.90486E-03	-3.11928E-08	2.15922E-11
1.000E&03	7.28717E-03	-6.12999E-08	4.23356E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-12

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	6.19299E-08	1.45069E-10	-9.23623E-14
2.000E-00	1.65639E-07	2.34788E-10	-1.48963E-13
5.000E-00	5.25026E-07	4.07650E-10	-2.56623E-13
1.000E&01	1.05558E-06	5.55189E-10	-3.45538E-13
2.500E&01	1.77764E-06	6.08944E-10	-3.63442E-13
5.000E&01	1.76306E-06	2.80286E-10	-1.30894E-13
7.500E&01	1.99667E-06	-1.55222E-10	1.61543E-13
1.000E&02	2.80095E-06	-5.46699E-10	4.17245E-13
1.250E&02	3.79353E-06	-8.37659E-10	6.00610E-13
1.500E&02	4.53642E-06	-1.00620E-09	6.98393E-13
2.000E&02	4.55139E-06	-9.63919E-10	6.33044E-13
2.500E&02	3.73362E-06	-4.67867E-10	2.59545E-13
3.000E&02	5.28974E-06	3.68403E-10	-3.41400E-13
3.500E&02	1.21362E-05	1.40082E-09	-1.06938E-12
4.000E&02	2.47012E-05	2.46925E-09	-1.81365E-12
4.500E&02	3.99026E-05	3.40456E-09	-2.45772E-12
5.000E&02	5.16278E-05	4.03278E-09	-2.88201E-12
6.000E&02	3.93850E-05	3.66180E-09	-2.58691E-12
7.000E&02	8.63799E-09	-5.52301E-11	3.87635E-14
8.000E&02	2.00663E-04	-8.50652E-09	5.94489E-12
9.000E&02	1.45156E-03	-2.30337E-08	1.60486E-11
1.000E&03	5.46809E-03	-4.49156E-08	3.12237E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-13

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	1.75638E-06	4.05064E-09	-2.52996E-12
2.000E-00	4.70415E-06	6.56098E-09	-4.08367E-12
5.000E-00	1.49537E-05	1.14113E-08	-7.04775E-12
1.000E&01	3.01751E-05	1.55797E-08	-9.51424E-12
2.500E&01	5.12510E-05	1.72301E-08	-1.00984E-11
5.000E&01	5.10561E-05	8.22873E-09	-3.83492E-12
7.500E&01	5.71557E-05	-3.87800E-09	4.14996E-12
1.000E&02	7.95740E-05	-1.48750E-08	1.12074E-11
1.250E&02	1.08044E-04	-2.31720E-08	1.63530E-11
1.500E&02	1.30207E-04	-2.81394E-08	1.92118E-11
2.000E&02	1.33327E-04	-2.76673E-08	1.79005E-11
2.500E&02	1.08880E-04	-1.46271E-08	8.20849E-12
3.000E&02	1.43943E-04	7.99243E-09	-7.77580E-12
3.500E&02	3.22870E-04	3.63571E-08	-2.74281E-11
4.000E&02	6.66325E-04	6.61885E-08	-4.78438E-11
4.500E&02	1.10038E-03	9.29639E-08	-6.59655E-11
5.000E&02	1.46467E-03	1.12029E-07	-7.86547E-11
6.000E&02	1.25751E-03	1.08171E-07	-7.50402E-11
7.000E&02	2.98655E-05	1.69930E-08	-1.17090E-11
8.000E&02	3.98019E-03	-1.98325E-07	1.36056E-10
9.000E&02	3.27777E-02	-5.73129E-07	3.91964E-10
1.000E&03	1.28618E-01	-1.14082E-06	7.78400E-10

[illegible]

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[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-14

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	8.02704E-08	1.88178E-10	-1.19903E-13
2.000E-00	2.14678E-07	3.04547E-10	-1.93373E-13
5.000E-00	6.80371E-07	5.28724E-10	-3.33102E-13
1.000E&01	1.36766E-06	7.20000E-10	-4.48462E-13
2.500E&01	2.30229E-06	7.89410E-10	-4.71500E-13
5.000E&01	2.28296E-06	3.62730E-10	-1.69387E-13
7.500E&01	2.58685E-06	-2.02288E-10	2.10292E-13
1.000E&02	3.63009E-06	-7.09938E-10	5.42115E-13
1.250E&02	4.91589E-06	-1.08698E-09	7.79885E-13
1.500E&02	5.87649E-06	-1.30505E-09	9.06437E-13
2.000E&02	5.89057E-06	-1.24875E-09	8.20598E-13
2.500E&02	4.83366E-06	-6.03683E-10	3.34637E-13
3.000E&02	6.86898E-06	4.82468E-10	-4.46411E-13
3.500E&02	1.57717E-05	1.82243E-09	-1.39193E-12
4.000E&02	3.20782E-05	3.20807E-09	-2.35788E-12
4.500E&02	5.17661E-05	4.41965E-09	-3.19277E-12
5.000E&02	6.68889E-05	5.23108E-09	-3.74112E-12
6.000E&02	5.07409E-05	4.73608E-09	-3.34837E-12
7.000E&02	2.67735E-08	-1.10794E-10	7.78209E-14
8.000E&02	2.63783E-04	-1.11129E-08	7.77239E-12
9.000E&02	1.89831E-03	-3.00132E-08	2.09277E-11
1.000E&03	7.13811E-03	-5.84726E-08	4.06794E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-15

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	7.52086E-08	1.74025E-10	-1.09419E-13
2.000E-00	2.01368E-07	2.81823E-10	-1.76583E-13
5.000E-00	6.39680E-07	4.89959E-10	-3.04622E-13
1.000E&01	1.28963E-06	6.68515E-10	-4.10965E-13
2.500E&01	2.18541E-06	7.37721E-10	-4.35177E-13
5.000E&01	2.17386E-06	3.48855E-10	-1.63001E-13
7.500E&01	2.44048E-06	-1.72066E-10	1.82714E-13
1.000E&02	3.40479E-06	-6.43875E-10	4.87370E-13
1.250E&02	4.62009E-06	-9.98334E-10	7.08461E-13
1.500E&02	5.55578E-06	-1.20857E-09	8.29893E-13
2.000E&02	5.65485E-06	-1.17930E-09	7.67072E-13
2.500E&02	4.62139E-06	-6.08194E-10	3.40654E-13
3.000E&02	6.24060E-06	3.74156E-10	-3.57557E-13
3.500E&02	1.41177E-05	1.60063E-09	-1.21247E-12
4.000E&02	2.90412E-05	2.88481E-09	-2.09671E-12
4.500E&02	4.76725E-05	4.02954E-09	-2.87614E-12
5.000E&02	6.29526E-05	4.83172E-09	-3.41288E-12
6.000E&02	5.22560E-05	4.58354E-09	-3.19947E-12
7.000E&02	5.76047E-07	4.90402E-10	-3.40039E-13
8.000E&02	1.92910E-04	-9.07136E-09	6.26266E-12
9.000E&02	1.52379E-03	-2.56717E-08	1.76686E-11
1.000E&03	5.91175E-03	-5.08076E-08	3.48878E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-16

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	6.17067E-08	1.43095E-10	-9.01788E-14
2.000E-00	1.65186E-07	2.31708E-10	-1.45516E-13
5.000E-00	5.24536E-07	4.02738E-10	-2.50966E-13
1.000E&01	1.05697E-06	5.49326E-10	-3.38460E-13
2.500E&01	1.78915E-06	6.05529E-10	-3.57966E-13
5.000E&01	1.77875E-06	2.84967E-10	-1.33149E-13
7.500E&01	2.00004E-06	-1.43608E-10	1.51891E-13
1.000E&02	2.79315E-06	-5.31248E-10	4.02726E-13
1.250E&02	3.78888E-06	-8.21913E-10	5.84371E-13
1.500E&02	4.55167E-06	-9.93597E-10	6.83619E-13
2.000E&02	4.62076E-06	-9.66326E-10	6.29662E-13
2.500E&02	3.77828E-06	-4.93117E-10	2.75800E-13
3.000E&02	5.14676E-06	3.17826E-10	-3.01742E-13
3.500E&02	1.16759E-05	1.32824E-09	-1.00754E-12
4.000E&02	2.39742E-05	2.38399E-09	-1.73604E-12
4.500E&02	3.92425E-05	3.32211E-09	-2.37612E-12
5.000E&02	5.16330E-05	3.97474E-09	-2.81357E-12
6.000E&02	4.22335E-05	3.74184E-09	-2.61768E-12
7.000E&02	3.00953E-07	3.21847E-10	-2.23662E-13
8.000E&02	1.65433E-04	-7.62710E-09	5.27738E-12
9.000E&02	1.28490E-03	-2.14026E-08	1.47636E-11
1.000E&03	4.95783E-03	-4.22424E-08	2.90719E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-17

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	5.80316E-08	1.35926E-10	-8.65344E-14
2.000E-00	1.55214E-07	2.19992E-10	-1.39564E-13
5.000E-00	4.91988E-07	3.81964E-10	-2.40433E-13
1.000E&01	9.89173E-07	5.20212E-10	-3.23744E-13
2.500E&01	1.66588E-06	5.70602E-10	-3.40532E-13
5.000E&01	1.65226E-06	2.62682E-10	-1.22673E-13
7.500E&01	1.87109E-06	-1.45374E-10	1.51309E-13
1.000E&02	2.62470E-06	-5.12192E-10	3.90887E-13
1.250E&02	3.55487E-06	-7.84845E-10	5.62704E-13
1.500E&02	4.25117E-06	-9.42805E-10	6.54346E-13
2.000E&02	4.26559E-06	-9.03298E-10	5.93196E-13
2.500E&02	3.49904E-06	-4.38627E-10	2.43344E-13
3.000E&02	4.95582E-06	3.44842E-10	-3.19616E-13
3.500E&02	1.13692E-05	1.31215E-09	-1.00164E-12
4.000E&02	2.31420E-05	2.31327E-09	-1.69897E-12
4.500E&02	3.73883E-05	3.18979E-09	-2.30250E-12
5.000E&02	4.83817E-05	3.77870E-09	-2.70022E-12
6.000E&02	3.69322E-05	3.43222E-09	-2.42453E-12
7.000E&02	7.11219E-09	-4.85082E-11	3.40430E-14
8.000E&02	1.87728E-04	-7.96395E-09	5.56526E-12
9.000E&02	1.35880E-03	-2.15709E-08	1.50283E-11
1.000E&03	5.11968E-03	-4.20675E-08	2.92414E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-18

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	4.72049E-08	1.09589E-10	-6.91449E-14
2.000E-00	1.26353E-07	1.77444E-10	-1.11568E-13
5.000E-00	4.01144E-07	3.08382E-10	-1.92393E-13
1.000E&01	8.08129E-07	4.20555E-10	-2.59420E-13
2.500E&01	1.36715E-06	4.63322E-10	-2.74200E-13
5.000E&01	1.35885E-06	2.17502E-10	-1.01625E-13
7.500E&01	1.52916E-06	-1.10814E-10	1.16976E-13
1.000E&02	2.13662E-06	-4.07565E-10	3.09206E-13
1.250E&02	2.89781E-06	-6.29858E-10	4.48259E-13
1.500E&02	3.47940E-06	-7.60876E-10	5.24033E-13
2.000E&02	3.52753E-06	-7.38745E-10	4.81810E-13
2.500E&02	2.88524E-06	-3.74940E-10	2.09544E-13
3.000E&02	3.94764E-06	2.47343E-10	-2.34096E-13
3.500E&02	8.96781E-06	1.02188E-09	-7.75719E-13
4.000E&02	1.83957E-05	1.83031E-09	-1.33417E-12
4.500E&02	3.00667E-05	2.54747E-09	-1.82401E-12
5.000E&02	3.94860E-05	3.04450E-09	-2.15746E-12
6.000E&02	3.20521E-05	2.85477E-09	-1.99938E-12
7.000E&02	1.74178E-07	2.14418E-10	-1.49176E-13
8.000E&02	1.29384E-04	-5.90666E-09	4.09167E-12
9.000E&02	9.96438E-04	-1.65045E-08	1.13980E-11
1.000E&03	3.83404E-03	-3.25292E-08	2.24130E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-19

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	7.50513E-08	1.76669E-10	-1.13034E-13
2.000E-00	2.00648E-07	2.85862E-10	-1.82257E-13
5.000E-00	6.35437E-07	4.96065E-10	-3.13809E-13
1.000E&01	1.27616E-06	6.75108E-10	-4.22211E-13
2.500E&01	2.14375E-06	7.38669E-10	-4.42892E-13
5.000E&01	2.12376E-06	3.36266E-10	-1.56947E-13
7.500E&01	2.41365E-06	-1.94687E-10	2.01219E-13
1.000E&02	3.39309E-06	-6.70518E-10	5.13417E-13
1.250E&02	4.59178E-06	-1.02263E-09	7.36215E-13
1.500E&02	5.47860E-06	-1.22460E-09	8.53571E-13
2.000E&02	5.46534E-06	-1.16444E-09	7.67593E-13
2.500E&02	4.49264E-06	-5.50719E-10	3.03946E-13
3.000E&02	6.48815E-06	4.75973E-10	-4.37020E-13
3.500E&02	1.49576E-05	1.73786E-09	-1.33083E-12
4.000E&02	3.03094E-05	3.03759E-09	-2.24035E-12
4.500E&02	4.86465E-05	4.16692E-09	-3.02144E-12
5.000E&02	6.24214E-05	4.91167E-09	-3.52621E-12
6.000E&02	4.59543E-05	4.37860E-09	-3.10787E-12
7.000E&02	2.05213E-07	-2.97933E-10	2.10102E-13
8.000E&02	2.65346E-04	-1.08249E-08	7.60141E-12
9.000E&02	1.85994E-03	-2.88515E-08	2.01990E-11
1.000E&03	6.92970E-03	-5.59490E-08	3.90816E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-20

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	5.78136E-08	1.38124E-10	-8.97060E-14
2.000E-00	1.54364E-07	2.23329E-10	-1.44533E-13
5.000E-00	4.87555E-07	3.86929E-10	-2.48441E-13
1.000E&01	9.75899E-07	5.25401E-10	-3.33472E-13
2.500E&01	1.62695E-06	5.70576E-10	-3.46919E-13
5.000E&01	1.60658E-06	2.50878E-10	-1.16755E-13
7.500E&01	1.84582E-06	-1.65544E-10	1.68117E-13
1.000E&02	2.61089E-06	-5.35277E-10	4.14047E-13
1.250E&02	3.52361E-06	-8.05178E-10	5.86909E-13
1.500E&02	4.17461E-06	-9.55170E-10	6.74386E-13
2.000E&02	4.09259E-06	-8.87335E-10	5.91544E-13
2.500E&02	3.39327E-06	-3.84627E-10	2.07759E-13
3.000E&02	5.19577E-06	4.37453E-10	-3.93432E-13
3.500E&02	1.21229E-05	1.43427E-09	-1.10931E-12
4.000E&02	2.42175E-05	2.44589E-09	-1.82709E-12
4.500E&02	3.80904E-05	3.30387E-09	-2.42848E-12
5.000E&02	4.76104E-05	3.83521E-09	-2.79224E-12
6.000E&02	3.11364E-05	3.21690E-09	-2.31635E-12
7.000E&02	1.90255E-06	-8.09158E-10	5.78968E-13
8.000E&02	2.63469E-04	-9.61817E-09	6.85348E-12
9.000E&02	1.69268E-03	-2.45377E-08	1.74329E-11
1.000E&03	6.11027E-03	-4.68321E-08	3.31983E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-21

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	7.57172E-08	1.59321E-10	-9.08811E-14
2.000E-00	2.04373E-07	2.59195E-10	-1.47358E-13
5.000E-00	6.60081E-07	4.55111E-10	-2.56837E-13
1.000E&01	1.35855E-06	6.29534E-10	-3.51538E-13
2.500E&01	2.41364E-06	7.26206E-10	-3.90868E-13
5.000E&01	2.46862E-06	4.09541E-10	-1.86848E-13
7.500E&01	2.60954E-06	-5.39556E-11	9.39813E-14
1.000E&02	3.46389E-06	-4.97628E-10	3.55849E-13
1.250E&02	4.72750E-06	-8.56096E-10	5.61623E-13
1.500E&02	5.89806E-06	-1.10107E-09	6.95653E-13
2.000E&02	6.67564E-06	-1.21848E-09	7.32798E-13
2.500E&02	5.60520E-06	-8.63176E-10	4.80810E-13
3.000E&02	5.53286E-06	-1.18935E-10	-5.99357E-15
3.500E&02	1.01897E-05	8.97473E-10	-6.54215E-13
4.000E&02	2.19110E-05	2.05168E-09	-1.38029E-12
4.500E&02	4.00534E-05	3.19933E-09	-2.09492E-12
5.000E&02	6.04790E-05	4.19025E-09	-2.70549E-12
6.000E&02	7.97279E-05	5.08738E-09	-3.23632E-12
7.000E&02	3.60952E-05	3.50734E-09	-2.21349E-12
8.000E&02	8.99218E-06	-1.77409E-09	1.11399E-12
9.000E&02	4.01034E-04	-1.19469E-08	7.47540E-12
1.000E&03	2.20156E-03	-2.81515E-08	1.75689E-11

TABLE 6.- VARIANCES AND COVARIANCES AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-22

PRESSURE, ATM.	S2P	S2BP	S2CP
1.000E-00	2.77237E-08	7.90705E-11	-6.12064E-14
2.000E-00	7.28477E-08	1.26684E-10	-9.76916E-14
5.000E-00	2.22554E-07	2.15107E-10	-1.64440E-13
1.000E&01	4.27161E-07	2.83836E-10	-2.14130E-13
2.500E&01	6.48232E-07	2.78786E-10	-1.99138E-13
5.000E&01	6.30558E-07	6.34594E-11	-1.78295E-14
7.500E&01	8.35819E-07	-1.78790E-10	1.77441E-13
1.000E&02	1.23201E-06	-3.68048E-10	3.24723E-13
1.250E&02	1.56584E-06	-4.78172E-10	4.04350E-13
1.500E&02	1.67330E-06	-5.02718E-10	4.12146E-13
2.000E&02	1.36758E-06	-3.12287E-10	2.29350E-13
2.500E&02	1.72691E-06	1.27772E-10	-1.57187E-13
3.000E&02	4.43490E-06	7.04888E-10	-6.51832E-13
3.500E&02	9.62023E-06	1.28945E-09	-1.14559E-12
4.000E&02	1.50965E-05	1.74317E-09	-1.52271E-12
4.500E&02	1.70859E-05	1.92325E-09	-1.66393E-12
5.000E&02	1.25782E-05	1.68480E-09	-1.44848E-12
6.000E&02	1.67496E-06	-6.28724E-10	5.36295E-13
7.000E&02	1.66873E-04	-6.34921E-09	5.38992E-12
8.000E&02	1.12420E-03	-1.65971E-08	1.40437E-11
9.000E&02	4.25559E-03	-3.24456E-08	2.73891E-11
1.000E&03	1.21054E-02	-5.49086E-08	4.62678E-11

TABLE 7.- COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-1

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005278182E-00	8.85594E-07
2.000E-00	1.0010555406E-00	1.71748E-06
5.000E-00	1.0026381332E-00	4.11552E-06
1.000E&01	1.0052738719E-00	7.95821E-06
2.500E&01	1.0131667207E-00	1.89621E-05
5.000E&01	1.0262735773E-00	3.63849E-05
7.500E&01	1.0393205700E-00	5.30504E-05
1.000E&02	1.0523076986E-00	6.90955E-05
1.250E&02	1.0652349633E-00	8.45679E-05
1.500E&02	1.0781023639E-00	9.94827E-05
2.000E&02	1.1036575730E-00	1.27630E-04
2.500E&02	1.1289733261E-00	1.53459E-04
3.000E&02	1.1540496231E-00	1.76832E-04
3.500E&02	1.1788864640E-00	1.97597E-04
4.000E&02	1.2034838488E-00	2.15594E-04
4.500E&02	1.2278417776E-00	2.30666E-04
5.000E&02	1.2519602502E-00	2.42664E-04
6.000E&02	1.2994788273E-00	2.56900E-04
7.000E&02	1.3460395801E-00	2.57416E-04
8.000E&02	1.3916425086E-00	2.43773E-04
9.000E&02	1.4362876127E-00	2.16457E-04
1.000E&03	1.4799748925E-00	1.78349E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-2

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005270514E-00	9.63911E-07
2.000E-00	1.0010540089E-00	1.86686E-06
5.000E-00	1.0026343183E-00	4.46528E-06
1.000E&01	1.0052662900E-00	8.62282E-06
2.500E&01	1.0131481253E-00	2.05146E-05
5.000E&01	1.0262375844E-00	3.93439E-05
7.500E&01	1.0392683773E-00	5.73809E-05
1.000E&02	1.0522405040E-00	7.47850E-05
1.250E&02	1.0651539645E-00	9.16142E-05
1.500E&02	1.0780087587E-00	1.07889E-04
2.000E&02	1.1035423485E-00	1.38781E-04
2.500E&02	1.1288412733E-00	1.67397E-04
3.000E&02	1.1539055333E-00	1.93609E-04
3.500E&02	1.1787351284E-00	2.17266E-04
4.000E&02	1.2033300586E-00	2.38208E-04
4.500E&02	1.2276903238E-00	2.56275E-04
5.000E&02	1.2518159242E-00	2.71314E-04
6.000E&02	1.2993631303E-00	2.91739E-04
7.000E&02	1.3459716767E-00	2.98496E-04
8.000E&02	1.3916415636E-00	2.90934E-04
9.000E&02	1.4363727908E-00	2.69003E-04
1.000E&03	1.4801653585E-00	2.33937E-04

TABLE 7.- COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-3

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005276588E-00	1.05758E-06
2.000E-00	1.0010552229E-00	2.04752E-06
5.000E-00	1.0026373465E-00	4.89493E-06
1.000E&01	1.0052723235E-00	9.44892E-06
2.500E&01	1.0131630373E-00	2.24701E-05
5.000E&01	1.0262668364E-00	4.30866E-05
7.500E&01	1.0393113972E-00	6.28415E-05
1.000E&02	1.0522967197E-00	8.19129E-05
1.250E&02	1.0652228039E-00	1.00365E-04
1.500E&02	1.0780896499E-00	1.18224E-04
2.000E&02	1.1036456271E-00	1.52167E-04
2.500E&02	1.1289646512E-00	1.83675E-04
3.000E&02	1.1540467223E-00	2.12614E-04
3.500E&02	1.1788918403E-00	2.38822E-04
4.000E&02	1.2035000052E-00	2.62127E-04
4.500E&02	1.2278712170E-00	2.82357E-04
5.000E&02	1.2520054757E-00	2.99346E-04
6.000E&02	1.2995631340E-00	3.22985E-04
7.000E&02	1.3461729800E-00	3.31965E-04
8.000E&02	1.3918350137E-00	3.25547E-04
9.000E&02	1.4365492351E-00	3.03584E-04
1.000E&03	1.4803156442E-00	2.67134E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-4

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005271219E-00	9.52051E-07
2.000E-00	1.0010541503E-00	1.84300E-06
5.000E-00	1.0026346736E-00	4.40531E-06
1.000E&01	1.0052670067E-00	8.50280E-06
2.500E&01	1.0131499623E-00	2.02176E-05
5.000E&01	1.0262414097E-00	3.87657E-05
7.500E&01	1.0392743422E-00	5.65408E-05
1.000E&02	1.0522487597E-00	7.37043E-05
1.250E&02	1.0651646624E-00	9.03152E-05
1.500E&02	1.0780220501E-00	1.06395E-04
2.000E&02	1.1035612807E-00	1.36974E-04
2.500E&02	1.1288664516E-00	1.65383E-04
3.000E&02	1.1539375628E-00	1.91503E-04
3.500E&02	1.1787746143E-00	2.15190E-04
4.000E&02	1.2033776061E-00	2.36292E-04
4.500E&02	1.2277465382E-00	2.54653E-04
5.000E&02	1.2518814105E-00	2.70125E-04
6.000E&02	1.2994489762E-00	2.91851E-04
7.000E&02	1.3460803029E-00	3.00495E-04
8.000E&02	1.3917753909E-00	2.95380E-04
9.000E&02	1.4365342400E-00	2.76337E-04
1.000E&03	1.4803568503E-00	2.44217E-04

TABLE 7.- COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-5

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005268340E-00	1.04930E-06
2.000E-00	1.0010535747E-00	2.03179E-06
5.000E-00	1.0026332369E-00	4.85829E-06
1.000E&01	1.0052641404E-00	9.37963E-06
2.500E&01	1.0131428510E-00	2.23094E-05
5.000E&01	1.0262273681E-00	4.27818E-05
7.500E&01	1.0392535512E-00	6.23970E-05
1.000E&02	1.0522214005E-00	8.13305E-05
1.250E&02	1.0651309158E-00	9.96463E-05
1.500E&02	1.0779820972E-00	1.17368E-04
2.000E&02	1.1035094582E-00	1.51036E-04
2.500E&02	1.1288034836E-00	1.82269E-04
3.000E&02	1.1538641733E-00	2.10932E-04
3.500E&02	1.1786915272E-00	2.36862E-04
4.000E&02	1.2032855455E-00	2.59888E-04
4.500E&02	1.2276462281E-00	2.79839E-04
5.000E&02	1.2517735751E-00	2.96549E-04
6.000E&02	1.2993282618E-00	3.19631E-04
7.000E&02	1.3459496059E-00	3.28058E-04
8.000E&02	1.3916376071E-00	3.21101E-04
9.000E&02	1.4363922657E-00	2.98634E-04
1.000E&03	1.4802135815E-00	2.61789E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-6

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005273614E-00	8.30354E-07
2.000E-00	1.0010546288E-00	1.60753E-06
5.000E-00	1.0026358665E-00	3.84287E-06
1.000E&01	1.0052693812E-00	7.41778E-06
2.500E&01	1.0131558144E-00	1.76392E-05
5.000E&01	1.0262528329E-00	3.38228E-05
7.500E&01	1.0392910556E-00	4.93310E-05
1.000E&02	1.0522704825E-00	6.43036E-05
1.250E&02	1.0651911136E-00	7.87920E-05
1.500E&02	1.0780529488E-00	9.28154E-05
2.000E&02	1.1036002317E-00	1.19473E-04
2.500E&02	1.1289123313E-00	1.44228E-04
3.000E&02	1.1539892475E-00	1.66973E-04
3.500E&02	1.1788309803E-00	1.87582E-04
4.000E&02	1.2034375299E-00	2.05921E-04
4.500E&02	1.2278088960E-00	2.21856E-04
5.000E&02	1.2519450788E-00	2.35255E-04
6.000E&02	1.2995118944E-00	2.53965E-04
7.000E&02	1.3461379766E-00	2.61203E-04
8.000E&02	1.3918233253E-00	2.56384E-04
9.000E&02	1.4365679407E-00	2.39377E-04
1.000E&03	1.4803718227E-00	2.10980E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-7

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005266811E-00	8.18516E-07
2.000E-00	1.0010532689E-00	1.58471E-06
5.000E-00	1.0026324726E-00	3.78862E-06
1.000E&01	1.0052626130E-00	7.31354E-06
2.500E&01	1.0131390400E-00	1.73927E-05
5.000E&01	1.0262197717E-00	3.33514E-05
7.500E&01	1.0392421952E-00	4.86437E-05
1.000E&02	1.0522063105E-00	6.34072E-05
1.250E&02	1.0651121175E-00	7.76925E-05
1.500E&02	1.0779596162E-00	9.15181E-05
2.000E&02	1.1034796888E-00	1.17797E-04
2.500E&02	1.1287665284E-00	1.42195E-04
3.000E&02	1.1538201349E-00	1.64607E-04
3.500E&02	1.1786405084E-00	1.84909E-04
4.000E&02	1.2032276489E-00	2.02969E-04
4.500E&02	1.2275815562E-00	2.18652E-04
5.000E&02	1.2517022306E-00	2.31831E-04
6.000E&02	1.2992438801E-00	2.50198E-04
7.000E&02	1.3458525974E-00	2.57232E-04
8.000E&02	1.3915283825E-00	2.52357E-04
9.000E&02	1.4362712353E-00	2.35447E-04
1.000E&03	1.4800811560E-00	2.07303E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-8

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005265082E-00	9.93117E-07
2.000E-00	1.0010529235E-00	1.92286E-06
5.000E-00	1.0026316126E-00	4.59738E-06
1.000E&01	1.0052609039E-00	8.87527E-06
2.500E&01	1.0131348505E-00	2.11081E-05
5.000E&01	1.0262116697E-00	4.04770E-05
7.500E&01	1.0392304577E-00	5.90364E-05
1.000E&02	1.0521912145E-00	7.69529E-05
1.250E&02	1.0650939401E-00	9.42875E-05
1.500E&02	1.0779386344E-00	1.11062E-04
2.000E&02	1.1034539293E-00	1.42943E-04
2.500E&02	1.1287370992E-00	1.72532E-04
3.000E&02	1.1537881442E-00	1.99704E-04
3.500E&02	1.1786070642E-00	2.24307E-04
4.000E&02	1.2031938592E-00	2.46179E-04
4.500E&02	1.2275485293E-00	2.65158E-04
5.000E&02	1.2516710745E-00	2.81088E-04
6.000E&02	1.2992197898E-00	3.03222E-04
7.000E&02	1.3458400054E-00	3.11562E-04
8.000E&02	1.3915317211E-00	3.05409E-04
9.000E&02	1.4362949369E-00	2.84621E-04
1.000E&03	1.4801296530E-00	2.50201E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-9

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005268877E-00	4.46651E-07
2.000E-00	1.0010536816E-00	8.65220E-07
5.000E-00	1.0026335004E-00	2.07003E-06
1.000E&01	1.0052646548E-00	3.99819E-06
2.500E&01	1.0131440416E-00	9.51426E-06
5.000E&01	1.0262294318E-00	1.82484E-05
7.500E&01	1.0392561707E-00	2.66137E-05
1.000E&02	1.0522242582E-00	3.46832E-05
1.250E&02	1.0651336943E-00	4.24834E-05
1.500E&02	1.0779844790E-00	5.00237E-05
2.000E&02	1.1035100944E-00	6.43259E-05
2.500E&02	1.1288011042E-00	7.75585E-05
3.000E&02	1.1538575086E-00	8.96613E-05
3.500E&02	1.1786793074E-00	1.00563E-04
4.000E&02	1.2032665008E-00	1.10189E-04
4.500E&02	1.2276190886E-00	1.18465E-04
5.000E&02	1.2517370710E-00	1.25319E-04
6.000E&02	1.2992692191E-00	1.34495E-04
7.000E&02	1.3458629453E-00	1.37262E-04
8.000E&02	1.3915182495E-00	1.33324E-04
9.000E&02	1.4362351316E-00	1.22684E-04
1.000E&03	1.4800135918E-00	1.05992E-04

TABLE 7.- COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-10

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005263313E-00	8.13045E-07
2.000E-00	1.0010525699E-00	1.57389E-06
5.000E-00	1.0026307296E-00	3.76202E-06
1.000E&01	1.0052591419E-00	7.26112E-06
2.500E&01	1.0131304743E-00	1.72651E-05
5.000E&01	1.0262030140E-00	3.31047E-05
7.500E&01	1.0392176191E-00	4.82850E-05
1.000E&02	1.0521742896E-00	6.29437E-05
1.250E&02	1.0650730254E-00	7.71315E-05
1.500E&02	1.0779138266E-00	9.08673E-05
2.000E&02	1.1034216250E-00	1.16991E-04
2.500E&02	1.1286976848E-00	1.41268E-04
3.000E&02	1.1537420061E-00	1.63597E-04
3.500E&02	1.1785545889E-00	1.83855E-04
4.000E&02	1.2031354331E-00	2.01911E-04
4.500E&02	1.2274845387E-00	2.17636E-04
5.000E&02	1.2516019057E-00	2.30901E-04
6.000E&02	1.2991414242E-00	2.49584E-04
7.000E&02	1.3457539883E-00	2.57126E-04
8.000E&02	1.3914395983E-00	2.52944E-04
9.000E&02	1.4361982540E-00	2.36883E-04
1.000E&03	1.4800299555E-00	2.09641E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-11

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005265339E-00	8.90040E-07
2.000E-00	1.0010529749E-00	1.72313E-06
5.000E-00	1.0026317394E-00	4.11935E-06
1.000E&01	1.0052611528E-00	7.95171E-06
2.500E&01	1.0131354361E-00	1.89096E-05
5.000E&01	1.0262127194E-00	3.62597E-05
7.500E&01	1.0392318496E-00	5.28859E-05
1.000E&02	1.0521928269E-00	6.89381E-05
1.250E&02	1.0650956513E-00	8.44714E-05
1.500E&02	1.0779403227E-00	9.95062E-05
2.000E&02	1.1034552067E-00	1.28088E-04
2.500E&02	1.1287374789E-00	1.54630E-04
3.000E&02	1.1537871392E-00	1.79019E-04
3.500E&02	1.1786041877E-00	2.01121E-04
4.000E&02	1.2031886245E-00	2.20792E-04
4.500E&02	1.2275404494E-00	2.37887E-04
5.000E&02	1.2516596625E-00	2.52266E-04
6.000E&02	1.2992002533E-00	2.72361E-04
7.000E&02	1.3458103968E-00	2.80165E-04
8.000E&02	1.3914900931E-00	2.75048E-04
9.000E&02	1.4362393422E-00	2.56863E-04
1.000E&03	1.4800581440E-00	2.26454E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-12

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005265795E-00	7.51851E-07
2.000E-00	1.0010530659E-00	1.45579E-06
5.000E-00	1.0026319658E-00	3.48087E-06
1.000E&01	1.0052616016E-00	6.72015E-06
2.500E&01	1.0131365298E-00	1.59834E-05
5.000E&01	1.0262148117E-00	3.06505E-05
7.500E&01	1.0392348457E-00	4.47039E-05
1.000E&02	1.0521966317E-00	5.82696E-05
1.250E&02	1.0651001697E-00	7.13935E-05
1.500E&02	1.0779454598E-00	8.40927E-05
2.000E&02	1.1034612962E-00	1.08222E-04
2.500E&02	1.1287441408E-00	1.30611E-04
3.000E&02	1.1537939935E-00	1.51163E-04
3.500E&02	1.1786108545E-00	1.69762E-04
4.000E&02	1.2031947237E-00	1.86286E-04
4.500E&02	1.2275456011E-00	2.00612E-04
5.000E&02	1.2516634867E-00	2.12623E-04
6.000E&02	1.2992002825E-00	2.29254E-04
7.000E&02	1.3458051111E-00	2.35410E-04
8.000E&02	1.3914779725E-00	2.30566E-04
9.000E&02	1.4362188667E-00	2.14624E-04
1.000E&03	1.4800277938E-00	1.88373E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-13

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005382078E-00	3.96618E-06
2.000E-00	1.0010763069E-00	7.67250E-06
5.000E-00	1.0026899509E-00	1.83218E-05
1.000E&01	1.0053771804E-00	3.53373E-05
2.500E&01	1.0134225412E-00	8.39470E-05
5.000E&01	1.0267770490E-00	1.60878E-04
7.500E&01	1.0400635234E-00	2.34610E-04
1.000E&02	1.0532819644E-00	3.05829E-04
1.250E&02	1.0664323720E-00	3.74786E-04
1.500E&02	1.0795147462E-00	4.41574E-04
2.000E&02	1.1054753944E-00	5.68687E-04
2.500E&02	1.1311639090E-00	6.86931E-04
3.000E&02	1.1565802899E-00	7.95803E-04
3.500E&02	1.1817245372E-00	8.94700E-04
4.000E&02	1.2065966509E-00	9.82982E-04
4.500E&02	1.2311966310E-00	1.06001E-03
5.000E&02	1.2555244774E-00	1.12518E-03
6.000E&02	1.3033637695E-00	1.21767E-03
7.000E&02	1.3501145270E-00	1.25653E-03
8.000E&02	1.3957767501E-00	1.23910E-03
9.000E&02	1.4403504386E-00	1.16478E-03
1.000E&03	1.4838355927E-00	1.03689E-03

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-14

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005266204E-00	8.56544E-07
2.000E-00	1.0010531477E-00	1.65852E-06
5.000E-00	1.0026321695E-00	3.96571E-06
1.000E&01	1.0052620069E-00	7.65628E-06
2.500E&01	1.0131375254E-00	1.82102E-05
5.000E&01	1.0262167446E-00	3.49209E-05
7.500E&01	1.0392376575E-00	5.09322E-05
1.000E&02	1.0522002641E-00	6.63874E-05
1.250E&02	1.0651045644E-00	8.13390E-05
1.500E&02	1.0779505584E-00	9.58061E-05
2.000E&02	1.1034676277E-00	1.23293E-04
2.500E&02	1.1287514718E-00	1.48795E-04
3.000E&02	1.1538020908E-00	1.72201E-04
3.500E&02	1.1786194846E-00	1.93380E-04
4.000E&02	1.2032036534E-00	2.12193E-04
4.500E&02	1.2275545970E-00	2.28499E-04
5.000E&02	1.2516723155E-00	2.42162E-04
6.000E&02	1.2992080770E-00	2.61063E-04
7.000E&02	1.3458109381E-00	2.68017E-04
8.000E&02	1.3914808986E-00	2.62429E-04
9.000E&02	1.4362179586E-00	2.44190E-04
1.000E&03	1.4800221181E-00	2.14211E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-15

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005267123E-00	8.20047E-07
2.000E-00	1.0010533313E-00	1.58742E-06
5.000E-00	1.0026326289E-00	3.79426E-06
1.000E&01	1.0052629261E-00	7.32320E-06
2.500E&01	1.0131398281E-00	1.74123E-05
5.000E&01	1.0262213653E-00	3.33865E-05
7.500E&01	1.0392446116E-00	4.86957E-05
1.000E&02	1.0522095669E-00	6.34789E-05
1.250E&02	1.0651162313E-00	7.77873E-05
1.500E&02	1.0779646047E-00	9.16400E-05
2.000E&02	1.1034864786E-00	1.17986E-04
2.500E&02	1.1287751887E-00	1.42470E-04
3.000E&02	1.1538307349E-00	1.64988E-04
3.500E&02	1.1786531174E-00	1.85419E-04
4.000E&02	1.2032423360E-00	2.03629E-04
4.500E&02	1.2275983908E-00	2.19487E-04
5.000E&02	1.2517212818E-00	2.32865E-04
6.000E&02	1.2992675723E-00	2.51705E-04
7.000E&02	1.3458812075E-00	2.59310E-04
8.000E&02	1.3915621874E-00	2.55095E-04
9.000E&02	1.4363105121E-00	2.38902E-04
1.000E&03	1.4801261814E-00	2.11439E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-16

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005264033E-00	7.44095E-07
2.000E-00	1.0010527139E-00	1.44048E-06
5.000E-00	1.0026310890E-00	3.44334E-06
1.000E&01	1.0052598585E-00	6.64633E-06
2.500E&01	1.0131322492E-00	1.58041E-05
5.000E&01	1.0262065083E-00	3.03040E-05
7.500E&01	1.0392227772E-00	4.41997E-05
1.000E&02	1.0521810559E-00	5.76171E-05
1.250E&02	1.0650813443E-00	7.06024E-05
1.500E&02	1.0779236425E-00	8.31728E-05
2.000E&02	1.1034342683E-00	1.07076E-04
2.500E&02	1.1287129333E-00	1.29283E-04
3.000E&02	1.1537596373E-00	1.49701E-04
3.500E&02	1.1785743806E-00	1.68217E-04
4.000E&02	1.2031571629E-00	1.84711E-04
4.500E&02	1.2275079844E-00	1.99063E-04
5.000E&02	1.2516268451E-00	2.11157E-04
6.000E&02	1.2991686838E-00	2.28138E-04
7.000E&02	1.3457826791E-00	2.34892E-04
8.000E&02	1.3914688309E-00	2.30888E-04
9.000E&02	1.4362271393E-00	2.15990E-04
1.000E&03	1.4800576043E-00	1.90863E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-17

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005265754E-00	7.27752E-07
2.000E-00	1.0010530577E-00	1.40912E-06
5.000E-00	1.0026319452E-00	3.36929E-06
1.000E&01	1.0052615599E-00	6.50473E-06
2.500E&01	1.0131364209E-00	1.54710E-05
5.000E&01	1.0262145789E-00	2.96679E-05
7.500E&01	1.0392344737E-00	4.32708E-05
1.000E&02	1.0521961055E-00	5.64016E-05
1.250E&02	1.0650994742E-00	6.91049E-05
1.500E&02	1.0779445798E-00	8.13971E-05
2.000E&02	1.1034600018E-00	1.04753E-04
2.500E&02	1.1287423714E-00	1.26425E-04
3.000E&02	1.1537916888E-00	1.46318E-04
3.500E&02	1.1786079539E-00	1.64322E-04
4.000E&02	1.2031911666E-00	1.80318E-04
4.500E&02	1.2275413271E-00	1.94187E-04
5.000E&02	1.2516584352E-00	2.05813E-04
6.000E&02	1.2991934946E-00	2.21916E-04
7.000E&02	1.3457963448E-00	2.27880E-04
8.000E&02	1.3914669857E-00	2.23198E-04
9.000E&02	1.4362054174E-00	2.07775E-04
1.000E&03	1.4800116398E-00	1.82373E-04

TABLE 7.- COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-18

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005263410E-00	6.51419E-07
2.000E-00	1.0010525893E-00	1.26110E-06
5.000E-00	1.0026307774E-00	3.01467E-06
1.000E&01	1.0052592351E-00	5.81907E-06
2.500E&01	1.0131306900E-00	1.38374E-05
5.000E&01	1.0262033871E-00	2.65333E-05
7.500E&01	1.0392180912E-00	3.86999E-05
1.000E&02	1.0521748023E-00	5.04473E-05
1.250E&02	1.0650735205E-00	6.18159E-05
1.500E&02	1.0779142456E-00	7.28208E-05
2.000E&02	1.1034217168E-00	9.37452E-05
2.500E&02	1.1286972161E-00	1.13182E-04
3.000E&02	1.1537407434E-00	1.31049E-04
3.500E&02	1.1785522988E-00	1.47248E-04
4.000E&02	1.2031318821E-00	1.61674E-04
4.500E&02	1.2274794935E-00	1.74221E-04
5.000E&02	1.2515951329E-00	1.84789E-04
6.000E&02	1.2991304958E-00	1.99603E-04
7.000E&02	1.3457379708E-00	2.05450E-04
8.000E&02	1.3914175579E-00	2.01866E-04
9.000E&02	1.4361692571E-00	1.88735E-04
1.000E&03	1.4799930684E-00	1.66651E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-19

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005267632E-00	8.31151E-07
2.000E-00	1.0010534330E-00	1.60948E-06
5.000E-00	1.0026328813E-00	3.84884E-06
1.000E&01	1.0052634250E-00	7.43125E-06
2.500E&01	1.0131410297E-00	1.76765E-05
5.000E&01	1.0262236167E-00	3.38987E-05
7.500E&01	1.0392477610E-00	4.94407E-05
1.000E&02	1.0522134625E-00	6.44411E-05
1.250E&02	1.0651207213E-00	7.89505E-05
1.500E&02	1.0779695373E-00	9.29874E-05
2.000E&02	1.1034918412E-00	1.19648E-04
2.500E&02	1.1287803742E-00	1.44371E-04
3.000E&02	1.1538351362E-00	1.67048E-04
3.500E&02	1.1786561272E-00	1.87549E-04
4.000E&02	1.2032433473E-00	2.05740E-04
4.500E&02	1.2275967964E-00	2.21482E-04
5.000E&02	1.2517164746E-00	2.34646E-04
6.000E&02	1.2992545181E-00	2.52749E-04
7.000E&02	1.3458574778E-00	2.59196E-04
8.000E&02	1.3915253537E-00	2.53414E-04
9.000E&02	1.4362581457E-00	2.35319E-04
1.000E&03	1.4800558540E-00	2.05850E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-20

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005268678E-00	7.38709E-07
2.000E-00	1.0010536418E-00	1.43090E-06
5.000E-00	1.0026334010E-00	3.42318E-06
1.000E&01	1.0052644573E-00	6.61141E-06
2.500E&01	1.0131435574E-00	1.57318E-05
5.000E&01	1.0262284946E-00	3.01732E-05
7.500E&01	1.0392548118E-00	4.40052E-05
1.000E&02	1.0522225088E-00	5.73493E-05
1.250E&02	1.0651315857E-00	7.02493E-05
1.500E&02	1.0779820424E-00	8.27209E-05
2.000E&02	1.1035070956E-00	1.06381E-04
2.500E&02	1.1287976682E-00	1.28279E-04
3.000E&02	1.1538537603E-00	1.48316E-04
3.500E&02	1.1786753720E-00	1.66375E-04
4.000E&02	1.2032625030E-00	1.82332E-04
4.500E&02	1.2276151536E-00	1.96064E-04
5.000E&02	1.2517333237E-00	2.07453E-04
6.000E&02	1.2992662223E-00	2.22765E-04
7.000E&02	1.3458611989E-00	2.27510E-04
8.000E&02	1.3915182534E-00	2.21198E-04
9.000E&02	1.4362373859E-00	2.03821E-04
1.000E&03	1.4800185963E-00	1.76417E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-21

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005256146E-00	7.59786E-07
2.000E-00	1.0010511385E-00	1.46788E-06
5.000E-00	1.0026271653E-00	3.49908E-06
1.000E&01	1.0052520604E-00	6.73967E-06
2.500E&01	1.0131131250E-00	1.59863E-05
5.000E&01	1.0261694964E-00	3.06198E-05
7.500E&01	1.0391691141E-00	4.46642E-05
1.000E&02	1.0521119781E-00	5.82598E-05
1.250E&02	1.0649980885E-00	7.14606E-05
1.500E&02	1.0778274452E-00	8.42892E-05
2.000E&02	1.1033158975E-00	1.08851E-04
2.500E&02	1.1285773351E-00	1.31926E-04
3.000E&02	1.1536117581E-00	1.53440E-04
3.500E&02	1.1784191663E-00	1.73296E-04
4.000E&02	1.2029995598E-00	1.91385E-04
4.500E&02	1.2273529386E-00	2.07598E-04
5.000E&02	1.2514793028E-00	2.21829E-04
6.000E&02	1.2990509869E-00	2.43927E-04
7.000E&02	1.3457146122E-00	2.56928E-04
8.000E&02	1.3914701787E-00	2.60230E-04
9.000E&02	1.4363176864E-00	2.53461E-04
1.000E&03	1.4802571353E-00	2.36629E-04

TABLE 7. - COMPRESSIBILITY FACTORS AND STANDARD ERRORS AT EVEN INCREMENTS OF PRESSURE

RUN NO. HE-0-22

PRESSURE, ATM.	Z	SZ
1.000E-00	1.0005281723E-00	5.95831E-07
2.000E-00	1.0010562473E-00	1.15804E-06
5.000E-00	1.0026398888E-00	2.78308E-06
1.000E&01	1.0052773456E-00	5.39314E-06
2.500E&01	1.0131751242E-00	1.28792E-05
5.000E&01	1.0262894485E-00	2.47253E-05
7.500E&01	1.0393429728E-00	3.60221E-05
1.000E&02	1.0523356973E-00	4.68511E-05
1.250E&02	1.0652676218E-00	5.72382E-05
1.500E&02	1.0781387465E-00	6.71889E-05
2.000E&02	1.1036985960E-00	8.57608E-05
2.500E&02	1.1290152458E-00	1.02487E-04
3.000E&02	1.1540886959E-00	1.17259E-04
3.500E&02	1.1789189464E-00	1.29954E-04
4.000E&02	1.2035059972E-00	1.40452E-04
4.500E&02	1.2278498484E-00	1.48636E-04
5.000E&02	1.2519504999E-00	1.54399E-04
6.000E&02	1.2994222038E-00	1.58300E-04
7.000E&02	1.3459211091E-00	1.51656E-04
8.000E&02	1.3914472156E-00	1.34617E-04
9.000E&02	1.4360005235E-00	1.09142E-04
1.000E&03	1.4795810327E-00	8.38019E-05

TABLE 8. - Compressibility apparatus zero pressure volume ratio

Run No.	N	Deviation from Average N
HE-0-1	1.994538±0.000103	-0.000121
HE-0-2	1.994597±0.000117	-0.000062
HE-0-3	1.994559±0.000130	-0.000100
HE-0-4	1.994589±0.000118	-0.000070
HE-0-5	1.994646±0.000129	-0.000013
HE-0-6	1.994577±0.000102	-0.000082
HE-0-7	1.994655±0.000101	-0.000004
HE-0-8	1.994645±0.000122	-0.000014
HE-0-9	1.994683±0.000054	+0.000024
HE-0-10	1.994710±0.000101	+0.000051
HE-0-11	1.994686±0.000110	+0.000027
HE-0-12	1.994680±0.000092	+0.000021
1/HE-0-13	1.993266±0.000489	-0.001393
HE-0-14	1.994671±0.000105	+0.000012
HE-0-15	1.994689±0.000101	+0.000030
HE-0-16	1.994711±0.000092	+0.000052
HE-0-17	1.994707±0.000089	+0.000048
HE-0-18	1.994727±0.000080	+0.000068
HE-0-19	1.994710±0.000102	+0.000051
HE-0-20	1.994698±0.000090	+0.000039
HE-0-21	1.994776±0.000100	+0.000117
HE-0-22	1.994590±0.000064	-0.000069

Average N = 1.994659±0.000022

Average standard error of N = ±0.000100

Standard error of a single N = ±0.000062

1/ The value of N for this run was omitted from the calculations.

average N, the average standard error of N, and the standard error of a single N.

Values for the constant B of equation (10) at 0° C for each of the twenty-two runs are recorded in table 9 along with the average B, the standard error in the average B, the average standard error of B, and the standard error of a single B.

Values for the constant C of equation (10) at 0° C for each of the twenty-two runs are recorded in table 10 along with the average C, the standard error in the average C, the average standard error of C, and the standard error of a single C.

Values for the compressibility factor of helium at 0° C and 1 atmosphere for each of the twenty-two runs are recorded in table 11 along with the average Z, the standard error in the average Z, the average standard error of Z, and the standard error of a single Z.

Values for the compressibility factor of helium at 0° C and 700 atmospheres for each of the twenty-two runs are recorded in table 12 along with the average Z, the standard error in the average Z, the average standard error of Z, and the standard error of a single Z.

The data for run No. HE-0-13 are not consistent with the data of the other twenty-one runs. No error was found in the calculations of run No. HE-0-13; therefore, an error must have been made in the experimental observations for that run. The data for run No. HE-0-13 were omitted from the calculations of the various average quantities and standard errors of tables 8, 9, 10, 11, and 12.

TABLE 9. - Values for the constant B at 0° C

Run No.	B x 10^4, atm^{-1}	(Deviation from Average B) x 10^4, atm^{-1}
HE-0-1	5.27866±0.00751	+0.00989
HE-0-2	5.27098±0.00808	+0.00221
HE-0-3	5.27706±0.00884	+0.00829
HE-0-4	5.27169±0.00795	+0.00292
HE-0-5	5.26881±0.00878	+0.00004
HE-0-6	5.27408±0.00694	+0.00531
HE-0-7	5.26728±0.00685	-0.00149
HE-0-8	5.26555±0.00831	-0.00322
HE-0-9	5.26935±0.00375	+0.00058
HE-0-10	5.26378±0.00679	-0.00499
HE-0-11	5.26581±0.00744	-0.00296
HE-0-12	5.26626±0.00629	-0.00251
1/HE-0-13	5.38262±0.03298	+0.11385
HE-0-14	5.26667±0.00717	-0.00210
HE-0-15	5.26759±0.00685	-0.00118
HE-0-16	5.26450±0.00622	-0.00427
HE-0-17	5.26622±0.00609	-0.00255
HE-0-18	5.26387±0.00544	-0.00490
HE-0-19	5.26810±0.00696	-0.00067
HE-0-20	5.26915±0.00620	+0.00038
HE-0-21	5.25660±0.00624	-0.01217
HE-0-22	5.28221±0.00514	+0.01344

Average B = 5.26877 x 10^{-4} ± 0.00149 x 10^{-4} atm^{-1}

Average standard error of B = ±0.00685 x 10^{-4} atm^{-1}

Standard error of a single B = ± 0.00568 x 10^{-4} atm^{-1}

1/ The value of B for this run was omitted from the calculations.

TABLE 10. - Values for the constant C at 0° C

Run No.	$C \times 10^{8}$, atm^{-2}	(Deviation from Average C) $\times 10^{8}$, atm^{-2}
HE-0-1	-4.7891 ± 0.0552	-0.1102
HE-0-2	-4.6933 ± 0.0554	-0.0144
HE-0-3	-4.7391 ± 0.0596	-0.0602
HE-0-4	-4.6812 ± 0.0533	-0.0023
HE-0-5	-4.6667 ± 0.0596	$+0.0122$
HE-0-6	-4.7037 ± 0.0467	-0.0248
HE-0-7	-4.6647 ± 0.0461	$+0.0142$
HE-0-8	-4.6425 ± 0.0561	$+0.0364$
HE-0-9	-4.6921 ± 0.0260	-0.0132
HE-0-10	-4.6348 ± 0.0454	$+0.0441$
HE-0-11	-4.6522 ± 0.0500	$+0.0267$
HE-0-12	-4.6598 ± 0.0426	$+0.0191$
1/HE-0-13	-5.4427 ± 0.2190	-0.7638
HE-0-14	-4.6645 ± 0.0486	$+0.0144$
HE-0-15	-4.6633 ± 0.0458	$+0.0156$
HE-0-16	-4.6392 ± 0.0416	$+0.0397$
HE-0-17	-4.6610 ± 0.0412	$+0.0179$
HE-0-18	-4.6394 ± 0.0365	$+0.0395$
HE-0-19	-4.6754 ± 0.0473	$+0.0035$
HE-0-20	-4.6896 ± 0.0428	-0.0107
HE-0-21	-4.5403 ± 0.0378	$+0.1386$
HE-0-22	-4.8640 ± 0.0423	-0.1851

Average $C = -4.6789 \times 10^{-8} \pm 0.0137 \times 10^{-8}$ atm^{-2}

Average standard error of $C = \pm 0.0467 \times 10^{-8}$ atm^{-2}

Standard error of a single $C = \pm 0.0628 \times 10^{-8}$ atm^{-2}

1/ The value of C for this run was omitted from the calculations.

TABLE 11. - Compressibility factor for helium at 0° C and 1 atmosphere

Run No.	Compressibility factor, Z	Deviation from Average Z
HE-0-1	1.000527818±0.000000886	+0.000000988
HE-0-2	1.000527051±0.000000964	+0.000000221
HE-0-3	1.000527659±0.000001058	+0.000000829
HE-0-4	1.000527122±0.000000952	+0.000000292
HE-0-5	1.000526834±0.000001049	+0.000000004
HE-0-6	1.000527361±0.000000830	+0.000000531
HE-0-7	1.000526681±0.000000819	-0.000000149
HE-0-8	1.000526508±0.000000993	-0.000000322
HE-0-9	1.000526888±0.000000447	+0.000000058
HE-0-10	1.000526331±0.000000813	-0.000000499
HE-0-11	1.000526534±0.000000890	-0.000000296
HE-0-12	1.000526580±0.000000752	-0.000000250
1/HE-0-13	1.000538208±0.000003966	+0.000011378
HE-0-14	1.000526620±0.000000857	-0.000000210
HE-0-15	1.000526712±0.000000820	-0.000000118
HE-0-16	1.000526403±0.000000744	-0.000000427
HE-0-17	1.000526575±0.000000728	-0.000000255
HE-0-18	1.000526341±0.000000651	-0.000000489
HE-0-19	1.000526763±0.000000831	-0.000000067
HE-0-20	1.000526868±0.000000739	+0.000000038
HE-0-21	1.000525615±0.000000760	-0.000001215
HE-0-22	1.000528172±0.000000596	+0.000001342

Average Z = 1.000526830 ± 0.000000179

Average standard error of Z = ±0.000000818

Standard error of a single Z = ±0.000000567

1/ The value of Z for this run was omitted from the calculations.

TABLE 12. - Compressibility factor for helium at 0° C and 700 atmospheres

Run No.	Compressibility factor, Z	Deviation from Average Z
HE-0-1	1.346040±0.000257	+0.000152
HE-0-2	1.345972±0.000298	+0.000084
HE-0-3	1.346173±0.000332	+0.000285
HE-0-4	1.346080±0.000300	+0.000192
HE-0-5	1.345950±0.000328	+0.000062
HE-0-6	1.346138±0.000261	+0.000250
HE-0-7	1.345853±0.000257	-0.000035
HE-0-8	1.345840±0.000312	-0.000048
HE-0-9	1.345863±0.000137	-0.000025
HE-0-10	1.345754±0.000257	-0.000134
HE-0-11	1.345810±0.000280	-0.000078
HE-0-12	1.345805±0.000235	-0.000083
1/HE-0-13	1.350115±0.001257	+0.004227
HE-0-14	1.345811±0.000268	-0.000077
HE-0-15	1.345881±0.000259	-0.000007
HE-0-16	1.345783±0.000235	-0.000105
HE-0-17	1.345796±0.000228	-0.000092
HE-0-18	1.345738±0.000205	-0.000150
HE-0-19	1.345857±0.000259	-0.000031
HE-0-20	1.345861±0.000228	-0.000027
HE-0-21	1.345715±0.000257	-0.000173
HE-0-22	1.345921±0.000152	+0.000033

Average Z = 1.345888 ± 0.000056

Average standard error of Z = ± 0.000255

Standard error of a single Z = ± 0.000129

1/ The value of Z for this run was omitted from the calculations.

DISCUSSION OF RESULTS

Examination of table 5 reveals that the signs of the differences between the observed and calculated pressures for the various runs are not random. This suggests that the assumed functional form does not adequately represent the data.

The influence of changes in the distortion coefficients α_1 and α_{1+2}, the effect of adding another constant (D) to equation (10), and the effect of changing the coefficient b of equation (4) will be explored in a future report.

A comparison of the data of this report with the data of other investigators, and statements concerning the precision and accuracy of the data of this investigation will be deferred until the above-mentioned tests are completed.

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